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Geographic Training, Wartime Research, and Immediate Professional Objectives[1]

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A. WARTIME PROFESSIONAL DEFICIENCIES

In the three years from 1941 to 1944 American geographers dealt almost constantly with a series of difficult professional problems. The profession as a whole may take pride in the manner in which these situations were met. Both the well-known and the previously obscure showed skill, imagination, energy, and unselfishness as they perspired over wartime tasks. Our techniques advanced, and the prestige of the profession increased notably during those years. Scholars and administrators who had scarcely heard of geography before Pearl Harbor are now familiar with its methods and its results. Geography unquestionably has wider recognition that ever before in this country.

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However, an assessment would hardly be honest if one were to stop with praise of our recent performance. Wartime experience has high-lighted a number of flaws in theoretical approach and in past methods of training men for the profession. It is no exaggeration to say that geography's wartime achievements are based more on individual ingenuity than on thorough, foresighted training. The geographer perfectly or even adequately trained for the specialty into which he was thrown has generally been an exception. The unfamiliarity of most young American geographers with foreign geographic literature; their almost universal ignorance of foreign languages; their bibliographic ineptness, and their general lack of systematic specialties are but a few points which may be cited in proof. All these were just as regular a source of difficulty as the strangeness of the problems and the pressure under which we worked.

No one, even among those who found themselves inadequately trained for their wartime jobs, would wish to indict the faculties of geography for their past planning of curricula. Many of the deficiencies which young wartime geographers discovered in their graduate school education can easily be justified. Yet there may be a lesson on professional training to be derived from our wartime experience, quite general in its bearing, and valuable for the future.

Among the several professional deficiencies which have had to be made good by improvised training of wartime geographers, two are as serious from the long term point of view as they have been from the immediate: inability to handle foreign language sources, and lack of competence in topical or systematic subjects. Although the first presents a complicated problem, it is so obvious a need that there is no occasion for discussing it in detail here. Most American intellectuals now appreciate the cultural value and practical advantages of being multilingual. Stimulated by stricter departmental requirements, and aided by improved methods of language instruction, geographers of the future probably will be much better equipped with languages than those of the past.

The second, lack of a systematic specialty among geography graduates, touches the heart of a well-known problem in our field—interpretation of its methodology. Although the main lines of methodological interpretation are familiar to almost every professional geographer, they might well be re-examined at this time, because of their bearing on future training and research in geography.

B. DUALISM AND THE NEGLECT OF SYSTEMATIC METHOD

If our profession has in some respects been tried and found wanting during the war, at least part of the cause can be sought in the past insistence

upon the essential duality[2] of our subject, traditional since ancient Greece, and battened down by nineteenth-century German methodological thought. Regional geography and systematic geography were, and still are thought of by many American scholars as two different and almost incompatible manners of study, with different objectives and different techniques. This belief is so much a part of the folklore of our field that it is accepted by nearly all authors without discussion. In the few recent instances where critical analysis and logical discussion are provided, as in Hartshorne's "The Nature of Geography," the same conclusion is reached.[3] Each of the two approaches is generally thought to lead to different ends, although the material brought forth by one is considered useful to the other. Since most geographers of the recent past have looked upon regional geography as the culmination of all study in this field, a bias toward regional techniques of study was a natural development.

Hence there has been coupled with acceptance of the dualistic view a tendency in the last twenty-five years to neglect the systematic method in our training and research and concentrate on the comprehensive or holistic regional approach.[4] Despite the convictions of the majority of American geography instructors and professors of the pre-war period as to the equal importance of the two methods,[5] the systematic approach consistently and

[2] Definitions of dualism offered in Webster's Unabridged are accepted for this paper. Dualism is "a system founded on double principle, . . . or . . . constituted by two mutually irreducible elements."

[3] Annals of the Assn. of American Geographers, vol. XXIX (1939), p. 574 (398). "These two different methods of dividing the field of geography (systematic and regional) cannot be combined on a single plane."

[4] The holistic regional approach is here taken to mean that manner of study wherein an areal unit (of whatever size) is the object of analysis and description in its cultural and physical entirety. It is typified by any of the numerous exhaustive "micro-geographic" papers which form part of our literature. There also are interpretative regional studies, which bring out subjective views as to the dominant character of an areal unit, and aim at much less complete description than the exhaustive type. Since these latter studies can be considered basic research only incidentally they do not enter this discussion as a central topic.

The systematic method, on the other hand, limits topically the field of investigation and description, whatever the size of the area.

The words "region," and "regional" are used hereafter in the sense of a geographic region—i.e., the concept which envisages the distributive aspects of the physical and cultural entirety of an area. No particular definition or size of a geographic region is proposed, except to recognize that it generally implies some homogeneity in the correlative aspects of a given core area.

[5] See Richard Hartshorne, "The Nature of Geography." These *Annals*, vol. XXIX (1939), pp. 626, and 645. "There is notable agreement, in practice, as well as in theory, on the importance of studies in regional geography, while at the same time there is a continued drive to develop various aspects of systematic geography."

progressively lagged behind the regional in its development and the interest shown in it. There are three lines of evidence: in published results of research, in college curricula, and in graduate theses.

To readers of the *Annals, Economic Geography,* and the *Geographical Review,* this may seem an unfounded statement insofar as it concerns published results of research. Indeed, if one examines the files of those periodicals in detail, he will find that examples of the systematic and the regional methods are about equal in numbers of published articles in those periodicals between 1918 and the present. However, closer examination of the systematic articles reveals several significant things.

(1) Many systematic studies of the past twenty-five years were undertaken by investigators who were more or less amateurs in the subject on which they published. These papers represented distributary interests of their authors, who plunged in without the equipment provided by previous apprenticeship, or the comprehensive background that superior systematic students need. The pool of young professionals in the thirties (who represented the majority of American geographers of that time) contained only a minority of competent systematic students. Furthermore, in human geography especially, it was common for individual authors to publish on two or more widely divergent phases of our field. Some students have published on as many as five different parts of the discipline! Surely we could expect significant results on more than one phase only in rare instances. Our recent systematic literature as a whole is a watered one.

(2) Many of the papers using the systematic approach were physical geography. Of 720 studies appearing in the important American professional periodicals during the last twenty-five years, nearly a third (32 per cent) were in the three best-explored subjects in that field: geomorphology, climatology, and soils geography. More than a third (35.8 per cent) were in agricultural geography and forestry. Less than a third were divided among the remaining possible systematic specialties in geography.[6] Our efforts toward the cultivation of systematic study thus have been decidedly lopsided, if one assumes validity for a quantitative sample.

Although one-sided attention is not necessarily a cardinal academic sin, it is significant in this instance. Some of the most important systematic subjects have been touched upon only occasionally by Amercian geographers. These subjects include the geographies of manufacturing, transportation, settlement, and resources—among the most essential in human geography.

[6] Political, industrial, military, settlement and cultural geography; the geographies of transportation, mineral resources; biogeography, oceanography, hydrography, and geodesy.

What there is on these topics understandably exhibits a strong bias toward the United States as the locus of study.

Among the systematic branches of human geography only the geography of agriculture, and possibly political geography, has received adequate attention on a world-wide basis by our research workers and thinkers.[7]

For the numbers of studies in physical geography, we can claim only incidental credit, since the majority have been made by men who were primarily geologists, meteorologists, or soil scientists, and only secondarily geographers. Their training and subsequent approach to research was only incidentally geographic. One branch of physical geography, plant geography, has lain open for a long period with extremely few contributions by trained geographers, even though its findings would be significant in a half dozen other branches of geography. Carl Sauer has been the only noteworthy recent student who approached the field from a geographic background. We have had to wait for renewed interest on the part of botanists, like Hugh Raup and Cain, for plant geography to obtain the amount of attention it deserves.

We can only guess as to what would have been accomplished in other phases of physical geography without the very active interest of research workers from other disciplines. The men who consider themselves primarily geographers contributed far less to progress in systematic geography than our statistics, or past theoretical statements on geographic objectives would suggest.

When one gets down to a close analysis of mature geographic research in the last twenty or twenty-five years, he cannot escape the conclusion that systematic technique received considerably less competent attention than the holistic regional method in that period. Whether unconsciously or not, professional geography showed a decided holistic bias in its research methods from 1920 to 1944.

The neglect of systematic study in our field was even more prominently exhibited in some aspects of past geographic education. While pre-war professional geographers at least paid lip-service to the importance of systematic study in research, the same men minimized its significance as a means of instruction or training. Of 162 doctoral theses in geography accepted by American faculties between 1915 and 1935, almost two-thirds followed the regional method.[8] The systematic theses, as in the case of pub-

[7] This thesis agrees substantially with assessments by other critical students of the field. See Hartshorne, *op. cit.*, p. 413: "With the increasing interest . . . in full regional studies, necessarily including cultural as well as natural features, geographic research suffers from the lack of adequate foundation in systematic cultural geography. . . ."

[8] Regional 98, systematic 56, other 6.

lished research, furthermore included a large share of physical geography. Finally, approximately two-thirds of the course offerings above the elementary level during the 1920's and '30's were regional in their treatment. American geographic faculties thus were even further from according equal attention to systematic study in their curricula than they were in the case of published research.

In sum, the profession was tending to develop a circle of neglect for systematic study. Since most of our mature research workers were faculty members at one institution or another, a majority of geographers found intensive systematic study difficult because of the time which had to be spent on the preparation and maintenance of regional curricula. University instruction in the systematic method, on the other hand, suffered because of insufficient research background and inadequate literature. All these things meant that the graduate regional specialist came to dominate geographic personnel lists at the beginning of the war.

C. RECENT PROFESSIONAL EXPERIENCE

Conceivably, a bias toward the regional method may have been a good thing for geography during recent decades, and it may be an attitude which we should seek to continue in our post-war professional activity.

Certainly the past contributions of practitioners of the holistic regional method to geography and to scholarship as a whole stand unquestioned. Regional geographers pioneered in a point of view and in methods of organization which were later adopted and are still being used in other social sciences. Furthermore, integrated regional studies will always be important to geographic scholarship, and probably always will be considered an end in its research. To have developed patterns for these studies is an item of lasting credit to a generation of geographers. With the concept of a complete regional study, then, and with the patterns which have been developed for them, few professional critics would take issue.[9]

At the same time one can question the profitability of continuing the methods of training and research which have prevailed in the past. I think that we have reached a point where they are no longer valuable for originality and novelty, and that we can expect rapidly diminishing returns from continuing them. A review of some professional experience in the last five years seems to support this opinion.

Geography and geographers in this country were put to one of the severest practical tests that they have had by the many wartime demands

[9] John Leighly in "Methodologic Controversy in Nineteenth Century German Geography" offers a significant exception. (*Annals*, vol. XXVIII (1938), pp. 238–58).

placed on them in instruction programs for the Services, and especially in the research of government intelligence agencies. As far as research is concerned, our success in meeting those demands can be measured in terms of two criteria: the extent to which we were able to provide properly trained personnel, and the usefulness of the body of facts accumulated by our previous basic research. Our score was not high in either, and our deficiencies can be explained by the pre-war emphasis on the regional method in training and research, no less than by the novelty of the tasks.

However good the models for our past regional studies, the war still found us with a very scanty accumulation of basic materials for any geographic interpretation. Our literature provided adequate data for wartime geographic research on very few, if any parts of the world. Some of our most detailed and exhaustive studies, like those of Glenn Trewartha and Robert B. Hall on the Japanese Islands, have failed in many respects to supply all the regional information, or all of the types of regional information needed, even for the subjects they covered. Furthermore there was little suggestion that adequate materials ever would have been accumulated for wartime *or* peacetime, no matter how long we had worked, by the methods which prevailed in pre-war years. In most instances the information needed was of a sort which could have been gathered only by a group of systematic specialists. It covered so wide a range of subjects, in such detail that no practioner of the holistic regional method could have hoped to, or did cover them competently, even for a small area. I know of no major geographic research task undertaken since 1941 which found more than a minor part of its material in published or unpublished geographic literature. The bulk of required data had, and still have to be sought piecemeal from other sources. In many cases it was never found. Now, of course, special field investigations supplement file and library sources more and more, but the wartime test nonetheless revealed glaring deficiencies in our geographic literature.

It may be felt that wartime needs are so special that one is not fair in judging geographic accomplishment according to those needs. Members of the profession who are familiar with intelligence documents of the several government agencies which require geographic data know, however, that those demands are astonishingly broad, as well as exacting in detail. They cover practically every subject treated in geography, with a very high standard of performance required in all. Although organization and presentation would certainly differ, geographers working on almost any peacetime problem would be well supplied with basic data if they met research standards of the wartime intelligence agencies—in fact, better supplied than they have been at any period in the past.

Four things probably contributed to our somewhat disappointing stock of basic geographic research products: the small number of geographers who had time and funds for any research; the minor percentage of these devoting themselves to extensive systematic study; the concentration of some of our more able workers on subjective regional interpretations; and a mistaken view as to the simplicity of regional geographic analysis. Of these the last is probably the most significant from the point of view of the future of the profession.

Despite many illustrations of the geographic complexity of even the smallest area, we persisted in believing that one person, even at a graduate student level, is competent to study, understand, and interpret all phases of a given region, or locality. Nothing could be farther from realism, or more deadening to scholarly progress in geography from this period henceforth. With the complexity that is now evident in the study of settlement forms, agricultural occupance, industrial location, and governmental structure, to mention only a few—we can hope for very little more than we have received from the single "regional" worker. He has not, and cannot report adequately on all phases of anything more than a very simple element-complex. Where many elements are involved he usually has an appreciation only of the more obvious features of each. The holistic investigator has even less foundation for the complete correlation which he seeks, since accurate correlation requires a deeper understanding than observation alone. The results were plainly shown in the limited use which our literature, especially the regional, had in wartime tasks.

The regional method of research, once wartime geographic compilation and investigation was started, proved to have no more value than the past literature. Where anything more than superficial analysis was required in government work, the only possible course was one of systematic specialization. Dependable accumulations of data, and reliable interpretations of those data were not to be had otherwise.

That is why we found ourselves soon after the beginning of the war with an inappropriately trained personnel. Many of our professional corps possessed inapplicable regional specialties, and no other immediate competence. Just being a geographer, even though originally it led to employment, was not enough when it came to performance. The kind of geographer had even more significance. After the first frantic burst of effort very few responsible persons considered the pure regional geographer a specialist—even the best and most experienced among them. The superficiality of the "regionally" trained geographer's information—even bibliographically—was readily evident. If he had anything resembling a systematic specialty, he very soon turned to exploiting it. If he did not,

he (a) belatedly and hurriedly tried to learn a systematic specialty; or if he was either clever or fortunate, (b) he became an administrator who supervised groups of systematic specialists, or workers who were willing to learn a systematic specialty. Taken as a whole, those geographers who had mastered some systematic field before the war were notably more successful in wartime research than those with a regional background only.

D. FUTURE APPLICATION OF SYSTEMATIC METHODS

This first major test in a period of widespread popularity of the regional method in training and research should cause us to take stock critically. If our literature is to be composed of anything more than a series of pleasant cultural essays, and if our graduates are to hope for anything more than teaching positions we shall do well to consider a more specialized, or less diffuse approach. The demands of a future peacetime are not likely to prove any more tolerant of superficiality than the demands of wartime.

1. *The Possibility of a Fresh Approach*

If we generally were to take a somewhat different view of the field than the one generally current, we shall take a significant step toward resolving some methodological inconsistencies; providing a more scholarly basic literature; and graduating better trained students. Such a view would suggest that we: (1) recognize an essential unity in our field. There is no real dualism in its philosophic organization. (2) Stress a close relationship, rather than different orbits for systematic and regional geography. (3) Abandon the idea that for purposes of primary geographical study the world is a mosaic of localities, districts and regions, with a potential student assigned to describing each tile.

This view would suggest instead that the most efficient approach to complete geographic description and understanding of the world, a region, or even a locality lies by way of systematic dissection and analysis, rather than by mosaic description method. It suggests further (1) that most localities and all larger regions are so complex that they require analysis by several systematic specialists rather than by one reporter; and (2) that in the future no student of a region who lacks a systematic specialty should be considered a geographic specialist, or even worthy of a higher degree. Detailed systematic studies would then be considered a basic, inescapable phase of our training and research, and not, to use Finch's words, "a monkish retreat upon minutiae."[10]

[10] V. C. Finch. "Geographical Science and Social Philosophy," These *Annals*, Vol. XXXIX (1939), p. 7.

On the other hand cf. *ibid.* p. 27, "To state that the complex facts of a region are too diverse to be understood by any one individual may be true. . . ."

The keys to the whole problem of significant geographic research and foresighted training lie (1) in recognition of the part that systematic study must play in providing adequate data for regional interpretations; and (2) appreciation of the importance of painstaking detail in systematic research, as well as the broad interpretations of continental or world scale which have characterized past systematic geography. Thus if one were to attempt an analysis of the concept "geography," he might arrive at something like the accompanying diagram (Fig. 1).

2. *Reconciliation of the Unity View and Some American Geographic Thought of Recent Years*

Actually these suggestions are not inconsistent with the trend of American geographic thought, in spite of the very definite statements on the philosophical duality of geography. If we may take "The Nature of Geography" as an articulate summary of the majority in American geographic thought during the immediate pre-war period (although it is much more), several statements may be cited which show an appreciation of the importance of systematic research in regional geography. Indeed, any analytical reader will have difficulty in reconciling these comments, with the dualistic concept. For instance: "These two methods of organizing geographic knowledge (systematic and regional) are not only interconnected in every part, but are also by no means so distinct in practice as is frequently supposed. A systematic study need not cover the whole world, but may be limited to a continent or to any area within which there are variations in the feature studied . . ." (Hartshorne, *op. cit.* 406).

"Since (systematic geography) is not merely an integral part of geography, but forms the necessary base for the studies of regional geography, no geographer need berate these students . . ." (p. 434).

". . . the interpretation of the interrelations of phenomena within each region depends upon the type concepts and principles developed in systematic geography . . ." (p. 446).

"It is particularly . . . the students whose interest in regional geography has motivated them to make systematic studies who have most clearly indicated the type of work that systematic geography should undertake" (p. 426).

". . . we recognize no 'boundary between economic and regional geography' . . ." (p. 408).

". . . regional geography in itself is sterile; without the continuous fertilizations of generic concepts and principles from systematic geography, it could not advance to higher degrees of accuracy and certainty in its findings" (p. 468).

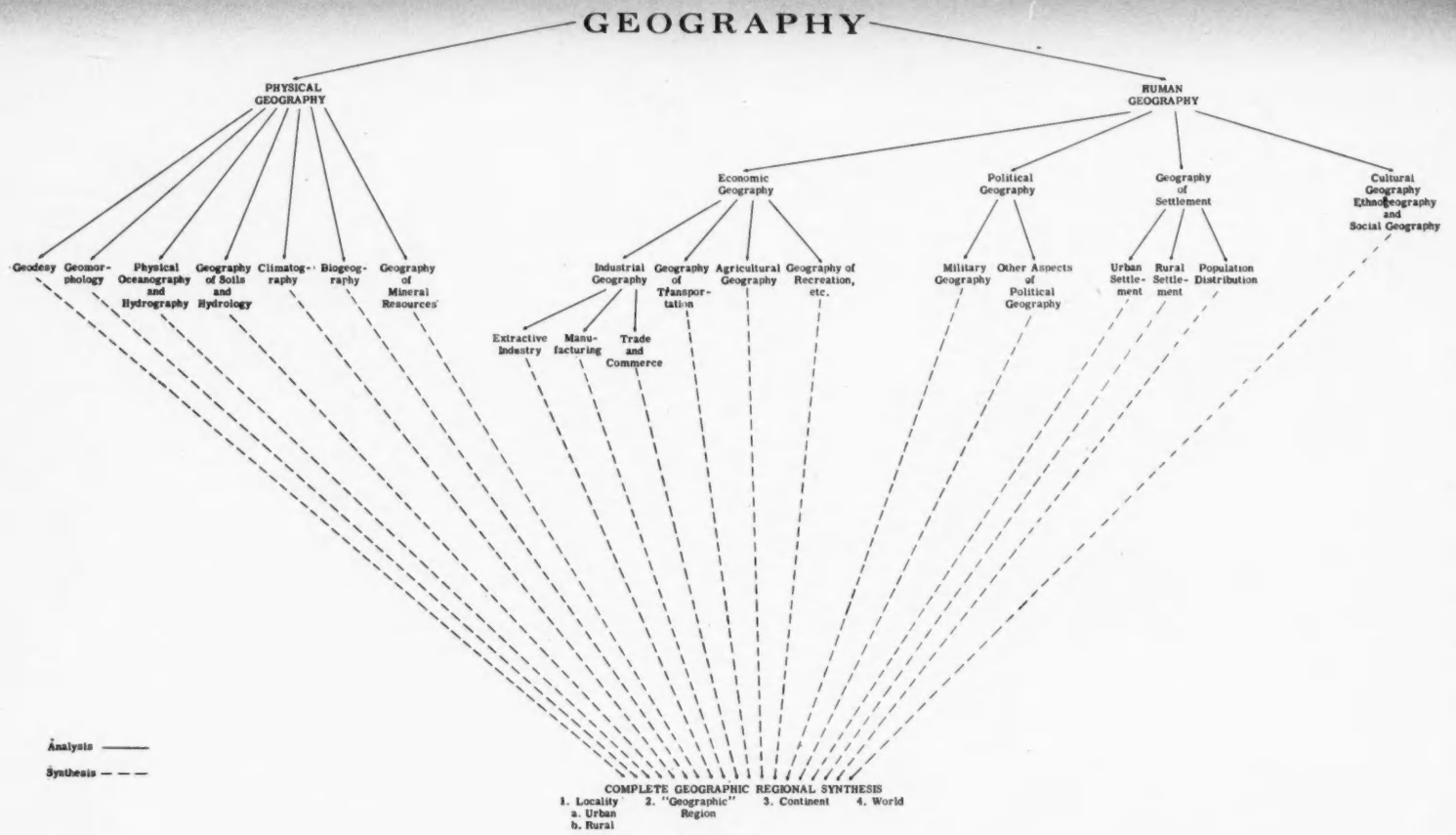
GEOGRAPHY
PHYSICAL GEOGRAPHY
HUMAN GEOGRAPHY
Geodesy
Geomorphology
Physical Oceanography and Hydrography
Geography of Soils and Hydrology
Climatography
Biogeography
Geography of Mineral Resources
Economic Geography
Political Geography
Geography of Settlement
Cultural Geography Ethnogeography and Social Geography
Industrial Geography
Geography of Transportation
Agricultural Geography
Geography of Recreation, etc.
Extractive Industry
Manufacturing
Trade and Commerce
Military Geography
Other Aspects of Political Geography
Urban Settlement
Rural Settlement
Population Distribution
Analysis
Synthesis
COMPLETE GEOGRAPHIC REGIONAL SYNTHESIS
1. Locality
a. Urban
b. Rural
2. "Geographic" Region
3. Continent
4. World

FIGURE 1

3. *Critical Examination of Some Past Reasons for Acceptance of the Dualistic View*

Several minor items have contributed to this contradictory situation, in which we recognize the close relationships between systematic and regional geography, and yet accept the traditional dualistic view. The first is the methodological suggestion that systematic geography does not concern itself with local or regional relationships, or correlations for the individual object of its study.[11] Any study of a single element[12] which takes account of relationships to other elements, according to this explanation, immediately becomes a partial regional study.[13]

If this concept is pursued to its logical end there is no systematic geography—everything is regional geography, or just geography. Even the simplest systematic description involves statements of space relationships, which amount to a sort of local or regional correlation. However, most readers will recognize that in actual practice systematic studies also involve statements of numerous other correlations. Systematic and regional geography therefore merge one with the other—the essential difference being the distinction between the treatment of the total element-complex of a given area (regional), and a treatment of separate components of the element-complex of the same area (systematic, or "partial regional").

A second contributing factor to the contradictory situation has been the arresting, but unfortunate simile which Hettner first used to solve the problem of describing philosophical distinction between systematic and regional studies. In this simile the geographic elements considered from a systematic point of view can be likened to a series of plane surfaces parallel to the earth's surface. Any individual part of systematic geography would be concerned with the phenomena on a single surface. Regional geography, on the other hand, would be represented by a limited section stricken through all of the parallel surfaces.

If we recognize, however, that there always are correlations present in any element complex, and that they are appropriate subjects of geographic study, the misleading nature of the parallel-plane-surfaces simile should be

[11] See Hartshorne, *op. cit.*, pp. 406–8. ". . . a full understanding of the difference between areas cannot be obtained by simply adding together the appropriate sections of systematic geography. It is necessary to study the totality of interrelations—this is regional geography" (p. 406), *ibid.*, p. 398.

[12] "Element" is here understood to mean any one of the features which enter into areal differentiation, cultural or physical. It is not limited in meaning to the elements of the environment, so-called.

[13] See Hartshorne, *op. cit.*, p. 398, for an explanation of the traditional difference between regional geography of an element complex and systematic geography.

apparent. The successive plane surfaces which represent the totality of geography, considered either systematically or regionally, then more appropriately become a solid. Regional geography is a vertical section, systematic geography a horizontal section of the solid. Any simile which does not express the intricate interconnections of the geographic complex is misleading.[14] A study in either branch of geography contributes material for the other, and any part of the element complex touches inevitably on some other parts. The solid thus may have opposite faces which suggest only remote relationship, but which nonetheless are part of the totality. We thus stress a philosophical unity, rather than the misleading duality.

Another contributing factor toward the dualistic view is the intimation that field observation (and therefore collection of primary data) does not fall within the province of systematic geography. Hartshorne expresses it in the following sentences: "Ideally, systematic geography receives from other sciences, or from general statistical sources, the necessary data concerning the distribution of any phenomenon; . . . . Further, ideally, it receives from the systematic sciences the explanation of the distribution of the phenomenon, that is, its genesis. . . . Geography starts with those facts and principles—assuming always, of course, that the systematic sciences concerned have provided them. . . ."[15] Use of the word "ideally" suggests departure in practice from the theoretical statement—a situation which actually prevails. And practice leads us to question the truth of theoretical statement.

If we admit that study of element correlations forms a part of systematic geography, an admission we can hardly avoid,[16] then systematic geographers must engage in the collection of primary data (and therefore field observation)—unless they ask students in other systematic sciences to do geographic research for them. Since the end in study of the other sciences is not areal differentiation, we can expect students in them to look into element correlations only incidentally. Systematic geography therefore cannot be assumed to start with material provided from other sciences.

Dualism was further favored, and primary research ignored, in the common assumption that systematic geography was largely concerned with building up laws and generalizations divorced from place. Here especially the insistence that systematic geography should be concerned only inciden-

[14] Cf. Hartshorne, *op. cit.* p. 439. ". . . in any finite area, however small, the geographer is faced with an interrelated complex of factors. . . ."

[15] Hartshorne, *op. cit.*, p. 424.

[16] Inasmuch as a simple statement of distribution involves a correlation—that between any given element and positions on the earth's surface.

tally with primary research has stood us in bad stead. There are inevitably two phases to sound systematic research (or any geographic study)—the collection of primary data (which includes data on correlations); and the interpretation of those data (which includes the formulation of "Laws" and generalizations). The second is badly conceived and executed without thorough attention to the first. At the same time, if we conceive systematic geography being *first* concerned with actual distributions or patterns, we see it just as near the "heart" of geography as our past concept of regional analysis. Indeed it turns out that they start from the same point.

It therefore becomes not only the interest, but the obligation of systematic geographers to collect primary data, and to provide statements on relationships for the several elements they treat. Systematic geography is then revealed in its true light as the analytical study which makes possible a regional synthesis, or total regional study.[17] No matter what the size of the area covered by a given systematic geographic study, it is always part of the regional geography of the same area, be that a locality, a district, a continent, or the world. The illusion of philosophic duality accordingly is dispelled.

4. *Summary Statement of a Monistic Geography*

In sum, the thesis that geography is a field of unity (and not duality) may be argued in the following manner, from the point of view of pure logic:

1. Geography is areal differentiation. The end-in-view of all geographic study, whether regional or systematic, is analysis and description of the whole of areal differentiation for the earth's surface. Areal differentiation (ideally) in turn has two aspects. (a) It is the differentiation among the several elements composing any region, including the world-region. (b) It is the differentiation between totalities of the several subregions of any regional entity, each composed of sets of varying elements or element complexes. Description of the totality of regional elements (or regional geography) is the description or interpretation of all elements significant to differentiation in their correlations with each other, or each with the whole minus one.

If students of regional geography must examine the correlations of elements with each other, and each with the whole minus one, then part of the process of regional geographic study is the observation, study, and interpretation of a single element or element complex in its correlative relations. Indeed, there must be a succession of individual element studies if one is to achieve understanding of regional totality.

[17] It is, of course, also the basis for systematic interpretation, or generalization.

2. One set of significant correlations is that between the element of space and all other significant elements—i.e., what is commonly called the distribution of a feature.

3. Therefore (a) there is no study of distribution without a study of correlation. Distribution always implies correlation.

(b) The study of distributions is a fundamental part of geography, and is properly a subject for primary geographic investigations.

4. If there is no study of distribution without a study of correlation, there is accordingly no study of systematic geography without a study of correlation.

5. Therefore there is no logical distinction between the "regional geography" of a single element, or element complex, and primary studies in systematic geography—the analysis of a single element or element complex for a limited area.

6. If the initial steps and the final objectives in the processes of study which we call systematic geography and regional geography are identical, there can be no dualism in the field. Systematic geography inevitably is partial regional geography, no matter what its subject, scope, or method of treatment. There can be no systematic geography which is not also partial regional geography; there can be no regional geography which is not based on systematic study. The only distinction between systematic and regional geography is that between the part and the whole. Geography therefore is monistic, not dualistic.

5. *The Immediate Need for Stressing the Systematic Approach*

Because of the methodological unity of their field, all geographers should be concerned about giving systematic studies a much larger share of their attention than they have in the recent past. Perhaps a different sort of simile may help to clarify this interest. Within the limits of exactness permitted by analogy we might think of our field as roughly comparable to a combination of the studies of anatomy and physiology in medicine. One method of studying a body and its functions might be analysis and description of individual parts—the head, an arm, a foot, a finger, a toe. That is akin to conventional regional geography, as exhibited in the majority of our curricula—where the world is studied by continents; a region by subregions, districts, localities. Such an approach to medicine will readily be recognized even by the layman as very elementary. Much more is to be discovered by analysis of like functional units—muscles, nerves, lymphatics, blood vessels, skeletal structure, etc. In fact, we might still be in the rabbit's-foot, witch-doctor stage if anatomical and physiological research had not proceeded primarily along the latter lines. Systematic

geography has some resemblance to this second type of medical study, in which the functional units are climates, soils, industries, and transportation units instead of muscles, bones, and nerves. Whether we are attempting to understand completely a region, or ultimately the world as a whole, we must have analysis provided by several systematic specialists. Suppose there had developed in medicine a specialist on the abdominal cavity. How conclusive could we expect any statement by him to be, if he did not have evidence provided by the research of neurologists, pediatricians, adrenologists, heart specialists, and several others? In fact, he would scarcely be deserving of the title "specialist." But that is exactly what we have been doing in geography. We have specialists on Latin America, Africa, Australia, the South, or the Mediterranean, who do not have the advantage of the experience and data which should, and can only be provided for them by students of industrial geography, political geography, settlement, or a dozen other subjects—data without which they can never hope for full understanding of a region or any part thereof. In general we are still relying on a country doctor method in the face of increasingly intricate problems.

This past method may be one reason for the concern which some critical students display for the development of regional science. Finch, for example, says that "perhaps . . . the regionalist may be forced to admit that the complexities of man and nature in area are too much for his abilities at rationalization."[18] Hartshorne, in turn, feels that ". . . no matter how many regions are studied, no matter by what methods, no scientific laws will be forthcoming."[19] These observations may be correct, and certainly they are supported by experience thus far. Are we not too near the beginning of our road, however, to make pessimistic forecasts of any sort? Should we not recognize that we merely are at the end of a stage, and probably poised to attack from another angle, instead of being so ready to admit our limitations?

E. BY-PRODUCTS OF ABANDONMENT OF THE DUALISTIC CONCEPT

Realization that all contributors to geography are closely allied workers toward a common goal will assist in the solution of problems in technique and personnel likely to arise in the future. We are facing some now for the first time, in common with other sciences, but the others have plagued us in the past, and they promise to continue their perplexing aspect indefinitely if we insist on dualism. I have selected three divergent examples

[18] Finch, *op. cit.*, p. 9.
[19] Hartshorne, *op. cit.*, p. 451.

from a number of possibilities to illustrate points of view which might be to our advantage: (1) appreciation of the transition area; (2) coming cooperative research; (3) efficient use of professional personnel.

1. *Appreciation of the Transition Area*

In dividing the world-region into blocks, or regions, for purposes of study or interpretation, we too often have assumed sharp contrasts must exist at boundaries. This is particularly true for simple, or elementary presentation of geographic data. The belief that some boundary always has to exist was reflected in the difficulty which all advanced students, practitioners, and critical observers of regional geography have in the selection, definition, and acceptance of regional boundaries. Only in a minority of cases, like the boundaries established by the power of social groups (e.g., political frontiers), or the line between irrigated valley and neighboring desert, are the criteria of definition and the results clear, to be agreed upon by independent observers. For other cases, because of the near impossibility of assigning fixed relative values to the several elements in a region, the boundary becomes a completely subjective, arbitrary matter. Where an attempt is made to decide upon a boundary for an element complex of any size or variety, the resulting division usually does violence to some part of the complex. There are two results: (a) In one or more respects, the region is not a region. It is a region only in the sense that a majority vote decides on issue. (b) One or more parts of the element complex are insufficiently studied, (if the regional boundaries are adhered to), with correspondingly inconclusive, and perhaps even erroneous interpretations.

Almost every advanced student therefore knows that most boundaries are in reality zones, even though they are usually expressed cartographically by lines. However, even though boundary zones are recognized, consciously or unconsciously, regional description usually stresses the features with some homogeneity. In other words, we concentrate our analysis on the cores of our regions, minimize the diversity within them, and often contribute thereby to the sharp boundary fallacy. But our science is just as concerned with diversity on the earth's surface (areal differentiation) as it is with homogeneity. Perhaps the diversities in the regional boundary zones are richer in meaning than the uniformity or unity within the regions. Although a few suggestive and informative papers on this subject have appeared,[29] the gradations between areas of maximum coincidence are worthy of more study than they have had.

If in our instruction and research we approach regional description by

[29] An excellent example is Russell Whitaker's "Agricultural Gradients in Southern Ontario," *Econom. Geogr.*, vol. 14 (1938), pp. 109–20.

way of systematic analysis, we ultimately may arrive at better understanding of the transitional area than we have. In this pattern of study we will readily recognize, as we do now, that there are majority elements and a core to every region. However, with a systematic treatment it will be easier to see that the minority elements and the transition zones are properly examined in their true extent. The conscious or unconscious subjective "weighting" which so often influences the results of regional research will be more easily avoided, and the complexity, number and size of the transition areas illustrated for all to see. We have said too much about the identification of areas of uniformity, forgetting that we are equally interested in grasping areal diversity. An appreciation of the value of systematic analysis to regional investigation may lead to a better-balanced literature.

2. *Cooperative Research*

Another question of technique based partly on expediency, but one which we must face, is appearing in the temper of many professional groups, and some university communities to engage in cooperative research. Although published results, as far as they concern geography, have in the main been limited to confidential issue, many scholars are planning on participation in projects which involve the cooperation of three or more workers within a discipline, or even more commonly, those which involve simultaneous approach from several different fields.[21]

Within our own field we can hope for little cooperative research without systematic specialties. By definition a regional specialist has interest in common only with another regional specialist for the same area. Since two geographers with similar regional specialties theoretically have the same background and competence, presumably there is little to be gained by their working together. Systematic students, on the other hand, must work cooperatively in order to achieve complete regional analysis. Not only can they together bring a much more efficiently concentrated effort to bear on a single problem than a similar-sized group using the regional method, but they have much more opportunity for cross-fertilization. Almost every experiment in wartime geographic research with which I am acquainted supports this thesis. It had commenced to become clear even before the war in some few projects of governmental research.

There is opportunity in the post-war period for even more interesting experiments in cooperative systematic research within geography. Indeed, it would seem the only hopeful method of solving the enormously complex problem of regional research. If we are willing, as many of us now are, to admit that the intricacies of any important region are too much for any one

[21] Such plans seem to be particularly current among social scientists.

student to handle perfectly, and are not to be satisfied with a scientific objective short of perfection—then systematic geographers working cooperatively on a regional problem are the only possible heirs to the individual regionalist.

The possibilities inherent in the cooperative systematic attack on regional problems have been obscured in the past not only by the general academic individualism, but by the repeated statement that a group of systematic geographical studies taken together cannot be added to make regional geography.[22] The individual regional geographer, it is maintained, must be present to dispense the nuptial interpretation. Theoretically, however, if the systematic studies are *perfect* (according to the premises set forward in Section D above) they could be added together to form regional geography. The fact that such an addition has not been achieved in the past can be explained by the near or total absence of cooperative research among systematic geographers. It is unlikely that an individual specialist can arrive at perfect understanding of all the correlative relationships connected with his subject without close contact with other students in neighboring specialties. But it is even more unlikely that an individual specializing on *all* relationships (the regional geographer of the immediate past) will attain that perfect understanding.[23] There remains for us as a possible method (if we are interested in progress) group research by systematic geographers, with different specialties, but interested at any time in the same region. In following that course we shall have not only sound logical footing, but we have an encouraging precedent in the success of groups working in other disciplines on similar methodological problems.[24] Their experience suggests that group research leads to understanding of the whole never reached by individual effort. For us it provides an answer to the problem as to how the regional approach may be preserved while we engage in searchingly detailed investigation.

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[22] Almost any published discussion of geographic methodology will provide an example of this view. See quoted statement from Hartshorne, note 10.

[23] The exception, of course, in either case, would be a geographer working on a very simple area, where only one or two element complexes were involved. We are concerned here, however, with a method which will be valid for any geographic problem, no matter how complex.

[24] Joséf Brozek and Ancel Keys discuss the status of cooperative research for science in general, with some observations of value to geographers in "General Aspects of Inter-Disciplinary Research in Experimental Human Biology," *Science*, vol. 100 (1944), pp. 507–12.

3. *Efficient Use of Professional Personnel*

Every field of professional research and training has to face the problem of what to do with those interested, assiduous members of its fraternity whom I shall call "technicians," for want of a better word. They are the people whose understanding of details much surpasses their abilities in analysis, interpretation, or invention. Geography has enrolled its share of students of this type, no less than other fields. But we have made comparatively poor use of them in the immediate past because emphasis has largely lain on the widely embracing analysis, synthesis, or interpretation necessary for the typical regional study. All research workers, including those with the technician mind, tried their hands at the individual regional study.

Almost every reader of professional geographic journals knows what the published results of the technicians amounted to during the past twenty years. A long series of superficial studies describing areas of every size remain as indelible evidence of their efforts. All too frequently "research" merely amounted to one writer's taking in the washing of another. There is exceedingly little of permanent value to be gleaned from many hundreds of pages of these studies. On the contrary, they have had a decided negative influence on the reputation of geography, as anyone knows who has discussed the subject with informed non-geographers.

Geography cannot avoid technicians in the future. In fact it should not wish to. As teachers they have been a valuable part of our professional group, and they can be made a significant part of our research potential. Their principal failing stems from their training in an atmosphere of emphasis on the regional method, sometimes under very eloquent advocates of regionalism. Very often, through no fault of their own, they had no appreciation of the complexities of regional study until too late in their careers.

Proper emphasis on the systematic in our training—underlining that method as the basis of all our research—would place our technicians in a state of mind, and provide them with a background much more useful to the advancement of our geographic knowledge. We can well take notice of what has been done in physics and biology in this respect. In those fields, just as in geography, there is a great deal of mechanical work of the mind and eye to be done. Workers in physics and biology similar to those here called technicians have not been encouraged of late to act as interpreters of the totality of one field or the other. Instead they have been steered into small, highly specialized corners, where they have almost always contributed toward knowledge in their field, and sometimes chanced upon important discoveries. Our hope for a similar procedure obviously lies

in getting our research organized into systematic channels, where a task can be found for every kind of intellect.

F. CONCLUSION

We are nearing a time when not only individual scientists, but communities of scholars, like members of this Association, should have the objectives of their profession clearly in mind, and decide upon an efficient approach to those objectives. One objective has been implicit in all of the preceding discussion. Few geographers, if any, would dissent from Platt's view that we "generally are committed to the study of regions."[25]

Many of us would go further, and maintain that presentation of complete description and interpretation of regions, and understanding of their similarities and differences, are ultimates in geography. However, should we not also recognize that there can be strategy in an approach to this objective, and that as a group we recently have employed a poor strategic plan? We have been making a frontal assault without the proper equipment—the background to be provided by much more searching investigations of a systematic nature.

Insistence upon the duality of geography, and the attraction of holistic regional study for planners of curricula and research has left our profession in a situation where we must contemplate a radical revision of approach. For those of us who accept the value of wartime experience, the handwriting on the wall is very clear. Geographers for the most part will struggle forward with primitive instruments if they do not redouble efforts toward systematic research, formulation of systematic principles, and provision of adequate training in systematic geographic methods. Believers in the validity of regional geography have as much at stake as anyone else, perhaps more, for the ultimate in regional geography quite clearly must wait upon progress as yet unattained in systematic study.

In directing our attention to systematic geography, however, we shall do well to take account of the different stages of development of the two major branches of our subject.

In physical geography the position of the several systematic subdivisions as primary sources of data and basic interpretations is so established that the suggestion of a different method has never occurred to anyone. It would indeed sound absurd to most of us if we were to suggest that progress in physical geography should depend largely on the holistic method. In-

[25] Robert S. Platt, "Regionalism in World Order," *Social Education*, vol. VIII, no. 3, March 1944, p. 105. Some other geographers would amend this to say instead that geographers are committed to the study of areas.

stead, we recognize the place of geodesy, geomorphology, soils geography, climatography, oceanography, and others. They are basic—the need of studying the systematic unit is recognized for each; their data are accepted, and sought for by the practitioner of regional synthesis. To suppose that any one student is qualified to gather data and make basic interpretations in all aspects of physical geography for even a small area—would seem nothing short of ridiculous to most professional geographers. Furthermore, exceedingly few, if any, would now consider study of a composite "natural" region an efficient approach in research or training for graduates or undergraduates interested in physical geography.

The place of systematic geography is well proven and recognized as the source of basic data and interpretations in physical geography. It remains for those of us interested in human geography to become equally advanced in methods of research and instruction. In this enormously more complex branch of geography we have persisted in believing that there is a short cut to regional description and interpretation which omits thorough grounding and investigation from a systematic point of view. I think that we are in the process of discovering that the short cut is instead a long detour—that without the basic data and formulation of principles supplied by the systematic study any regional student is in an unenviable position.

We might also say that human geography is in an unenviable situation, so long as there is the present emphasis upon regional methods of instruction. Many of our graduates know a little about a lot. They and their studies easily give a justified impression of superficiality to outsiders, a confused illustration of our ultimate objectives, and an example which encourages all sorts of incompetents to try their hand at geographic interpretation. Human geography (and ultimately regional geography) will never be accepted as a mature scholarly discipline until a more thorough systematic literature begins to take shape in it. That in turn is at least partly dependent on a reshaping of curricula in graduate schools.

Recognition of the basic position of systematic methods in our fields has in the past been somewhat discouraged by the uneasy feeling that perhaps systematic studies in geography are always much closer to some other field than they are to the totality of geography. This is illustrated by a final quotation from Hartshorne: ". . . only by constantly maintaining its relation to regional geography can systematic geography hold to the purpose of geography and not disappear into other sciences" (*op. cit.*, p. 468). A recent statement by an anonymous geographer expresses it unqualifiedly ". . . we must keep attempting regional synthesis, or confess that geography is not a field of knowledge, but simply the edges of other fields lumped together for no good reason." Others pursue this trend of thought, main-

taining, for example, that climatology and climatography will always be done by trained meteorologists, plant geography by botanists, soil geography by soil scientists, and so on.

We cannot deny that this tendency has appeared in all phases of physical geography, or that any systematic phase of geography must inevitably be closely related in practice to its allied field. However, the results brought forth in physical geography by students in other disciplines have not always been satisfactory, and systematic specialists of any sort have given cultural geography very little attention. From past performance there is no reason to think that students who approach systematic study, physical or cultural, as geographers, will not hold their own as contributors.

Indeed, there are three reasons for believing that a properly conducted systematic geography cannot possibly disappear into another systematic science. (1) Only the geographer appreciates, understands, and looks for all the correlations which characterize his study, and are essential to his science. (2) Complete systematic research in geography is just as concerned with actual distributions, as it is with generalizations and principles. No student who concerns himself primarily with actual earth patterns will ever stray far beyond the limits of geographic science. (3) A mature and progressive regional science inevitably will have to develop systematic research in geography. The relation of the systematic approach is logically just as close with regional geography as with any other field. In fact need for the thorough understanding of regions may be an important stimulus of systematic research.

So long as these characteristics of regional analysis and the systematic method are appreciated, the imagined danger that a geography emphasizing systematic studies will eventually liquidate itself is about as real as a belief that the field of history will disappear in the same manner.

Furthermore if we recognize the essential unity of geography, then we shall be grateful for any contribution to our field, whether it be by a geographer or non-geographer, and we shall cease to have imperialistic worries. Any advance in systematic research will also represent progress toward regional description, instead of being considered temporally competitive with regional efforts. This will be readily apparent if cooperative research on regional problems is pushed forward actively. Our progress may be most rapid if we interest ourselves more in the advancement of knowledge than in the advancement of geography.

Besides our academic objective, we may very well consider one other. We can do our profession little harm, and possibly a great deal of good if we ask ourselves "knowledge for what?"

Too often in the past we have been part of the mass of scientific drifters,

who excuse themselves by saying that the only real science is pure science, undisturbed by a practical eye.[26] But in an educational world that already shows signs of being even more critically utilitarian than in the past, can we not be efficient in reaching our academic objective, and at the same time have an eye for practical contributions on the way?[27] Viewed in this light, we have a final objective of complete description and interpretation of geographic totality, and we also have two immediate social obligations: presenting as clearly and truthfully as possible the geographic part of cultural education; and training specialists whose peculiar point of view can contribute toward contemporary solutions of social, economic, and governmental problems, national and international.[28] We shall not be honest if we do not admit that we have made less progress on either of these social obligations than we might have. It is especially true for the latter, providing competent specialists who are fitted *by training* to make a peculiar practical contribution. If we can take the best road to our academic objective, and at the same time perform these social duties on the way, we can consider ourselves fortunate. I think that we can, by recognizing that we are at a stage in the development of geography where systematic methods should be emphasized in training and research.

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[26] See Jose Ortega y Gasset, "The Revolt of the Masses," New York, 1932, p. 90, for an interesting modern statement of this position. See also Alexander W. Stern, "The Threat to Pure Science." *Science*, vol. 100 (1944), p. 356; and commentaries thereon by Eugene Robin and James Feibleman, *ibid.*, pp. 519–21; and by John M. Pearson, *ibid.*, 471–2.

[27] This point of view has been stated previously by other geographers, notably V. C. Finch, and J. Russell Whitaker. Finch, for example, says ". . . the idea that the only real knowledge is pure knowledge and free from all implication of practical consequence is rapidly going overboard" (*op. cit.*, p. 21).

[28] Cf. Howard Mumford Jones, "institutions of learning will welcome some positive program to link together the interests of the learned and the problems of society in the years immediately to come. . . ." "The Future of the Academy," *Presidential Address*, American Academy of Arts and Sciences, 1944, p. 9.

Recent Changes in the Concentration of Manufacturing

ALFRED J. WRIGHT*

INTRODUCTION

The expansion of manufacturing facilities in the United States between 1939 and 1945 focused attention upon an activty which has had generally minor attention in geographic literature. In view of the absolute and relative importance of manufacturing as a livelihood, the number and distribution of wage jobs in industry become of particular interest to geographers.[1]

The tasks of conversion for war production and reconversion to peacetime needs have thrust their unwelcome problems upon a nation now aroused to some of the consequences of such moves. Within the past four years more than twice as many wage earners in this country have become aware of the opportunities and limitations of factory employment as ever before in our history.

This study in the location of manufacturing activity in the United States since 1919 is an attempt to measure the changes in its concentration.

Industrialization of a Nation

From an agricultural nation, the United States had become primarily industrial by 1940, with 26 per cent of its wage earners engaged in manufacturing, 23 per cent in commerce and trade, and 17 per cent in agriculture. From the greatest debtor nation it had become the world's greatest creditor nation, a fact of profound importance to its agriculture, its manufacturing and in their relations to each other.

The circumstances attending this industrialization were unique in the sense that the Industrial Revolution made its first impact upon the economy of the infant nation before settlement of the interior had taken place. The numerical inadequacy of the population for the task of creating a nation in the midst of so much land and so many resources, led to the early and extensive use of powered machinery.

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[1] In 1919 agriculture produced 22.9 per cent and manufacturing 26 per cent of the national income; in 1940 it was 8 per cent and 22 per cent, respectively.

In an attempt to satisfy almost unlimited human wants with the decidedly limited means at hand, American industry has enormously increased the use of powered machinery. Many, but by no means all of our mechanical improvements have been made to economize in labor. Economy of raw materials has also been a goal. By building skill into machines, we in effect increased the number of skilled workers. A lower price and frequently a superior product resulted. No task was too commonplace to escape mechanization. The United States developed during a period of rising technology. As a result, in no other country has so much factory production been dependent upon so few wage earners. Six per cent of the world's population consumes 30 per cent of the world's industrial raw materials. The United States is a specialist in manufacturing, although certain other nations are more highly industrialized in terms of employment.

Concentration

During the establishment of this manufacturing economy the location of manufacturing activity has been concentrated in about four hundred counties.[2] It is primarily because of this pronounced concentration that widespread interest has been taken in the possible changes in industrial location.[3]

Even in the states with important industrial districts, many towns and some cities have long been concerned about the inadequacy of their industrial payrolls. Ever since colonial days, there have been populous communities faced with industrial stagnation. At first these communities looked to highway and canal construction to aid in the solution of their economic ills. Very few of them were to have the benefits of a canal, and highways did not live up to expectations.

Later on it was the coming of the steam railroad which was counted on to increase their industrial payrolls. Many southern and some western towns were passed by, as well as many smaller communities scattered throughout the eastern part of the country. In other towns the railroad service ultimately declined or ceased altogether. Hope flared again as the automobile and surfaced highway took nearly every town out of the mud. Many towns secured new employment as a result of the automobile, but it was more often as the home of commuting labor than the location of a new factory. Still there were depressed towns.

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[2] Richard Hartshorne. A New Map of the Manufacturing Belt of North America. *Econ. Geog.*, vol. 12 (1936), pp. 45–53; A. J. Wright. Manufacturing Districts of the United States. *Econ. Geog.*, vol. 14 (1938), pp. 195–201.

[3] See for example, The Senate Special Committee Investigating Industrial Centralization, Senator McCarran, Chairman, 78th Congress, Second Session, 1944.

Interest in decentralization

Since World War I, especially, the columns of trade journals and the public press have carried articles attempting to measure changes in industrial concentration. Under such beguiling titles as "Industry on the Move" and "War the Great Decentralizer," they sought to discern a trend away from the industrial concentrations toward non-manufacturing areas. The weakening ties of power sources and of raw materials were noted, likewise the growing importance of market and labor as location factors. It was common knowledge that since about 1910 there had been a widespread closing of many local industries, particularly in the East North Central and Northeastern states. Among them were flour mills, creameries, saw mills, woolen mills, kilns, cabinet shops, tan-yards, agricultural implement shops, and even automobile and tire factories. Other industries had deserted their original locations and moved to new regions. Perhaps the classic example is that of the Slater cotton mill in Rhode Island, first factory of any kind in this country, which moved to Slaterville, South Carolina. Cotton textiles, glass ceramics, wood products, and leather are the products of manufacturing industries which provide examples of this type of movement.

Several attempts have been made to measure the amount of industrial relocation during the inter-war period.[4]

At the same time the information concerning industrial changes has become more complete and more readily available.[5] In addition to the census of manufacturing, there are data covering the phenomenal increase in industrial facilities, up to June 1945, when plant facility allotments had virtually ceased. During the war period the usual plant location factors were not always the determining ones; war had imposed others. New power centers in the South and West were for the first time appraised as location factors in manufacturing. From an unemployed group numbering perhaps ten million, wage earners came to be at a premium. In 1943, the United States was divided into regions by the War Production Board on the basis of labor shortage; critical regions were awarded the minimum of war contracts.

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[4] D. B. Creamer, "Is Industry Decentralizing?" Philadelphia, 1936; G. McLaughlin, "Areal Growth in Manufacturing," University of Pittsburgh, Bureau of Business Research, 1934.

[5] Data from the War Production Board apportions the $17 billions furnished by the Government as follows: (millions of dollars): Defense Plant Corp., $7,833, Army, $393; Navy, $2,480, Maritime Com., $456, R.F.C., $225, United Kingdom, $167, for Jan. 1, 1945.

War Increased Facilities

Whereas the first world war cast the United States in the rôle of food producer for the Allies, the adoption of Lend Lease and the demands of participation in the second world war made this country a producer of factory products for the United Nations.

To manufacture $175 billions in war goods the Federal Government spent approximately $33 billions for new plant facilities of all kinds.[6] Of this new capacity, $20 billions went into industrial facilities, while $13 billions went into facilities designated by the War Production Board as

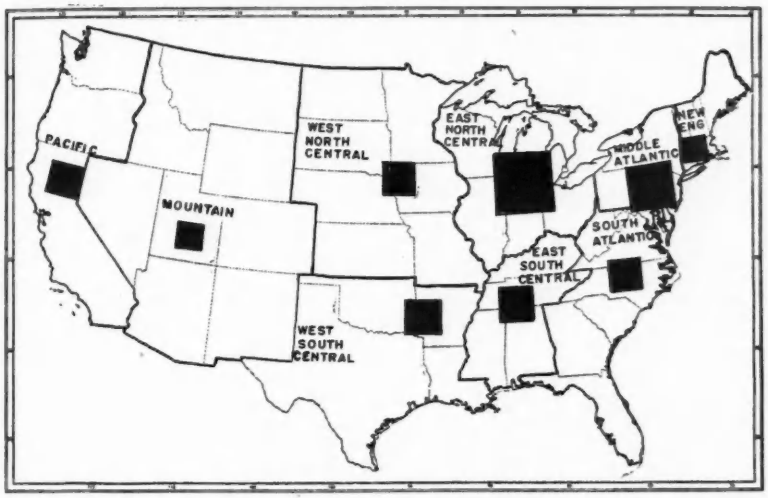

FIG. I.—Proportional Distribution of Industrial Facilities Financed by the Government, by Census Divisions, 1939–1944.

military. In this study only the increase in industrial facilities is considered. Every state in the manufacturing belt except Rhode Island received more industrial than military facilities, the average ratio being about two to one. At the other extreme were the states on the Pacific, Gulf, and the Atlantic coasts, and the interior states of Idaho, New Mexico and Arizona where military facilities exceeded industrial by rather a wide margin.

Distribution of facilities

The distribution of the $20 billions for industrial facilities is represented in Figure I. Although the share of these new facilities in terms of value

[6] This means that to win the war the United States increased its total production about 75 per cent; Great Britain's increase was about 30 per cent.

added by manufacture in 1939 was much higher in the states outside the manufacturing belt, the actual increase in capacity was in this order: Ohio, Pennsylvania, Michigan, Illinois, New York, California, Texas, and Indiana. The same states, although not in just the same order, led in war supply contracts.

The principal part of the increase in plant facilities was financed by Government money; private funds accounted for but 22 per cent of the total increase in productive capacity. Most of these private funds went into non-manufacturing enterprises such as power lines, mining properties, and various types of transportation facilities. Government financing was largely in the field of "war babies" (Table I).

TABLE I

Government Financing

Per cent of the industry's total facilities	Commodity	Per cent of all Government financing of plant facilities
95	Ship contruction and repair	14
65	Chemicals, oil & coal products	11
65	Iron, steel and products	10
20	Power lines, mining and transportation	8
48	Machinery, electrical equipment and apparatus	3

(Data from War Production Board, Summary, June 1, 1945.)

Although most of the private money went into non-industrial war plants, by no means the preponderate part of these industries were privately financed. Large power centers at Shasta on the Sacramento River, Bonneville and Grand Coulee on the Columbia, Boulder on the Colorado, and the several dams in the Tennessee Valley were publicly financed. Scores of mining properties were similarly financed; among them were mines producing tungsten, chromium, potash, magnesium, bauxite, copper, and even iron and petroleum.

Some of this industrial dispersal does not show in the award of contracts. Congestion and critical labor shortages arose, despite efforts of the War Production Board. This led to a tremendous increase in subcontracting in certain types of manufacturing. It brought many smaller and comparatively unknown districts into the war effort. Rail, truck and even air lines freight traffic assumed new patterns to make this possible. For the duration a great many communities outside, as well as inside, the manufac-

turing belt participated in filling the contracts credited to other and larger centers.

Hundreds of these communities of many sizes are today wondering to what extent their new industrial attachments and their increased population of wage earners will continue to function in peacetime.

If we take the data released by the Census of 1940 and by the War Production Board, June 1945, we can get some idea as to the amount and nature of changes in industrial concentration resulting from a major depression and the combined effects of a world war and heavy Government financing of facilities. For each of the Census divisions of the United States it is proposed to show: (1) the changes in industrial concentration between 1919 and 1939, and (2) the effects of expansion due to Lend Lease and the War between 1939 and 1945.

DISTRIBUTION OF MANUFACTURES BY CENSUS DIVISIONS

New England

New England is the oldest of American manufacturing regions and it has always been one of the three most important. A great variety of commodities is manufactured in these six states, although certain types of industry have never been established there. In general it has been a region which imports its raw materials, fashions them, and exports its skill and labor. It has never been a self-contained industrial region. The first factories to start there were dependent upon imported raw materials. Even the market for these early factory products was outside of the northeastern states. New England's industrial history has been one of increasing competition from other parts of the United States and with foreign producers.

The New England type

As a result of these factors, New England manufactures have tended to become something of a type. The "New England type" is a term used to describe factory goods with a relatively low bulk and high value added by the manufacturing process. It frequently involves a roundabout method of processing. New England probably was the first to practice subcontracting of parts in its manufactures.

New England was first to lose an important industry to another region. Cotton is undoubtedly the best known of these migrated industries, but it is by no means the only one. Flour milling, iron making, lumber and woodwork, worsted wool manufacture, and leather tanning also declined. In the manufacture of rubber tires and tubes, automobiles, glass, agricultural and construction machinery, several refining industries, and many food in-

dustries New England never attained an important position. A few industries became important elsewhere before New England took them up; among them are the manufacture of airplane engines, automobile parts, and steel ships.

Changes, 1919–1939

The Census measures the amount of manufacturing activity on three bases: (1) value added by manufacturing, (2) wages paid, and (3) the number of wage earners employed. On these three bases, expressed both absolutely and as a proportion of the national total, New England declined in manufacturing during this twenty-year period. All six states declined on all three bases. In Massachusetts, where two-thirds of the manufacturing took place, the decline was greatest. Connecticut declined least. In national standing, all states declined (Table II).

TABLE II

Relative Standing of the States in Manufacturing, 1919–1939. (Proportion of National Total)

State	Value added		Wage earners		Wages paid	
	1919	1939	1919	1939	1919	1939
New York	1	1	1	1	1	1
Penn.	2	2	2	2	2	2
Ohio	3	4	3	3	3	3
Illinois	4	3	5	4	4	5
Mass.	5	7	4	6	5	7
Mich.	6	5	7	5	6	4
N. J.	7	6	6	7	7	6
Calif.	8	8	11	9	10	8
Ind.	9	9	9	8	9	9
Wis.	10	11	10	12	11	11
Conn.	11	10	8	11	8	10
Mo.	12	12	12	13	12	12
N. C.	13	13	13	10	16	16
Md.	16	14	14	15	14	13
R. I.	16	16	15	17	15	15

(Census of Manufactures, 1940.)

During this twenty-year period New England gained in the manufacture of radio instruments, airplanes and engines, mechanical rubber goods, and electric motors, to mention the important ones. It seems to have reversed the trend of shoe manufacturing away from this region.

New facilities, 1939–1945

War contracts and the construction of new plant facilities during Lend Lease and World War II did not alter the general trend downward of

New England's manufacturing. Compared with the 9 per cent of the nation's "value added" which New England had in 1939, the 4½ per cent of total new facilities and 8 per cent of all war contracts are relatively low. No other Census division received so low a proportion of war facilities and contracts.

The distribution of new plants was overwhelmingly in the three southern New England states; Massachusetts received nearly three-fifths and Connecticut most of the remainder. The War Production Board divided New England into 14 industrial districts, and 12 of these received less than their proportional shares of facilities. The new plants were for the manufacture of airplanes, engines, and parts (Connecticut receiving 90 per cent of this item for New England), ordnance (Connecticut geting 60 per cent), and shipyards (Massachusetts getting 70 per cent). Ten of these 14 districts received at least five times their proportional share of war contracts. In other words, New England did the bulk of its war contract manufacturing in lines which its factories were already fitted to produce. The war made less change in the type of New England manufacturing than in any other Census division (Table III).

TABLE III

	Percentage distribution of industrial facilities financed by the government	Percentage distribution of value added by manufacturing
New England	5	9.0
East North Central	29	32.5
Middle Atlantic	18	30.0
South Atlantic	7	9.0
East South Central	9	4.3
West South Central	10	2.7
West North Central	9	5.0
Pacific	8	6.5
Mountain	5	0.8

Summary

The over-all picture of New England's manufacturing as a result of a depression, war, and Government spending for new facilities, has not changed essentially from the period beween the two world wars. The decline was general on all three bases of appraisal. The greatest decline was in Massachusetts. New England received the lowest proportional share of war contracts. To make them she got the lowest share of public financing of new facilities of any region. The reconversion of New England factories should therefore cause less dislocation than in any other division.

Middle Atlantic

Although the Middle Atlantic states are primarily commercial in their economy, they are as well the nation's leading manufacturing region. They are far more abundantly endowed with resources than New England. Local anthracite and bituminous coal, iron ore, petroleum and gas, clay, stone, and zinc have been incorporated into the industry of these states.

As a division, the Middle Atlantic states are not so highly specialized in their manufactures as New England. Yet in the New York metropolitan district there is the greatest specialization in the United States. In 1929 an Army Ordnance Survey created the New York Ordnance District. In it were 8,000 plants making a wide variety of metal products. When war came only 1,800 of these plants were able to convert for war contracts. Of this group, 1,500 were able to share in the war effort only because they handled subcontracts. Although this high degree of specialization is peculiar to only a very few of the districts in the Middle Atlantic states, they accounted for enough of the nation's manufactures to become a problem in the conversion for war production.

Changes between 1919 and 1939

On the same three-fold basis for appraisal used for New England, the Middle Atlantic states including New York, Pennsylvania, New Jersey, and Delaware, declined during this twenty-year period. New York and Pennsylvania declined the most, although their leadership had been too great to have their ranking changed. New Jersey declined least in the group, dropping one place in number of wage earners but advancing from seventh place to sixth in terms of value added by manufacture (Table II).

During this twenty-year period these states lost, relatively, in the manufacture of iron and steel, machine tools, cotton textiles, rubber tires and tubes, and in ships. They gained in the manufacture of airplanes, engines, and parts, in automobile engines and parts, chemicals and glass.

Changes, 1939–1945

Between 1940 and 1944 New York and Pennsylvania each lost about 4.5 per cent in population; New Jersey and Delaware gained population, 1.8 per cent and 5 per cent, respectively (Table IV). There was nothing in the effect of the war on industry in these states which materially altered the downward trend of the past twenty years. As with New England, the Middle Atlantic division received most of its war contracts in items which it was fitted to produce. The volume of these contracts was somewhat less than the share of these states in the nation's "value added" in 1939. New

facilities built to manufacture these war goods amounted to a little more than half the share of the value added by manufacture. Again, as in New England, the distribution of new plant facilities was concentrated in a few of the industrial districts of these states.

TABLE IV

Changes in Population by States 1943–1940

State	1943	1940	Per cent gain or loss
Mass.	4,255,204	4,316,721	-1.4
Conn.	1,779,854	1,709,242	4.1
N. Y.	12,858,202	13,479,142	-4.6
Penna.	9,465,765	7,900,180	-4.4
N. J.	4,234,463	4,160,165	1.8
Ohio	6,886,316	6,907,612	-0.3
Ind.	3,397,918	3,427,742	-0.9
Ill.	7,694,066	7,897,241	-2.6
Mich.	5,422,373	5,256,106	3.2
Wis.	3,010,322	3,137,587	-4.1
Md.	2,091,720	1,821,244	14.3
N. C.	3,637,975	3,571,623	1.9
S. C.	1,950,802	1,899,804	2.7
Ga.	3,225,431	3,123,723	3.3
Va.	3,077,497	2,667,773	14.9
Tenn.	2,950,668	2,915,841	1.5
Minn.	2,577,363	2,792,300	-7.0
Kans.	1,780,930	1,801,028	-1.1
Colo.	1,162,853	1,123,296	3.5
Utah	633,636	550,310	15.1
Texas	6,970,350	6,414,824	8.7
Okla.	2,168,066	2,336,434	-7.2
Calif.	8,466,522	6,907,387	22.6
Wash.	2,032,949	1,736,191	17.1
Ore.	1,228,218	1,315,834	13.4
Mo.	3,749,819	3,784,664	-0.9
La.	2,556,175	2,363,880	8.0

Only one of the twenty industrial districts of this Census division received a share of new facilities greater than that of its "value added," and only two other districts received shares equal to that of their "value added."

Summary

The trend in industrial activities, as measured by their share of the nation's total of wages paid, number of wage earners, and the value added by manufacturing, has been downward for a quarter century. The war did nothing to alter this trend. For the most part these states were called on to make products closely in line with their peacetime specialties. Reconversion of industrial plants will probably be less difficult for this division than for any other part of the United States except New England.

East North Central

The five states comprising this division have long been characterized by a balanced economy. That is to say, the number of wage earners engaged in agriculture, manufacturing, mining and quarrying, commerce, and the service industries are more or less equal.

No other division rivals it in the close interrelationship between agriculture and manufacturing. In no other division has the urbanization of agricultural areas been carried so far. It was tardy in the development of its farms and factories, following by more than a century the settlement of the eastern seaboard states. In a little more than a century these states have become the dominant half of the manufacturing belt.

Changes between 1919 and 1939

Taken as a whole, the division showed no great changes in manufacturing activity during the twenty-year period between 1919 and 1939. Using the same three bases employed in the eastern states, Michigan, Illinois, and Indiana gained in their proportion of the nation's total (Table II). Their gain was least in the number of wage earners. Ohio and Wisconsin just held their own in wages paid, and showed slight decline on the other bases. In national standing, only Michigan gained on all three bases.

During this period the East North Central states experienced appreciable industrial movement, loosely termed decentralization. A marked regional shift took place in the manufacture of agricultural implements. The center of this important industry moved from Ohio to Wisconsin and Illinois. Another industry showing important changes in its localization was the manufacture of automobiles. Originally it was a fairly well-dispersed type of industry, with perhaps two score cities having one or more automobile plants. The number of makes greatly declined, but parts manufacture and subcontracting have increased the volume of production and the geographical distribution of automotive wage jobs.

Other important shifts within the division occurred in rubber tires and tubes, machine tools, in airplanes, engines and parts, iron and steel manufacture, and in the manufacture of wool.

Greatest gains were experienced in iron and steel manufacture, ships, machine tools, railroad equipment, refrigeration and other electrical equipment, boots and shoes, chemicals, glass, and refining industries. Industries in which these states lost ground include flour milling, wool, ceramics, meat packing, and wood products.

Effects of the war

From 1939–44, all the states of this division except Michigan declined

slightly in population (Table IV). At first glance this division appears to have received somewhat more than its share of war contracts and new industrial facilities. It had 32 per cent of the total value added by manufacturing in 1939; it received 29 per cent of the nation's new plant facilities and 32 per cent of the war contracts. As compared with the New England and Middle Atlantic states this is a lion's share.

The distribution of war contracts over the five states in the division was much more uniform than with the ten states to the east.[7] This points to the general ability of the industries of this region to convert for war purposes.

The reverse is true of the distribution of new plant facilities; 20 of the 29 industrial districts received plant facilities in a proportion less than their "value added." Only three got facilities greater in proportion than the "value added."

Conversion to war work

In this connection it is worth while to recall how some of these midwestern plants were able to convert for war contracts. An outstanding example is the automobile industry. For these manufactureres, conversion meant almost complete retooling, and considering the enormous size of some of their machine tools, this was a very important factor. An estimated 80 per cent of the machine tools used in the production of automobiles had to be set out in vacant lots under a coat of heavy grease for the duration of the war. In England the proportions were just the reverse: 80 per cent of the tools were converted for war production. The tremendous difference is indicative of the degree to which this industry has become specialized in the United States.

New facilities

This specialization is borne out by the Government's share in the financing of new facilities for the manufacture of motor and combat vehicles, most of which came from these five states. There are normally 986 plants engaged in the manufacture of automobiles, engines and parts; 647 of them are located within the East North Central division. Their share of Government financing of new facilities was but 3 per cent of the total, the lowest of nine categories of public financing for the war effort. This sum represented but 20 per cent of the new automotive plant facilities in this region; the remaining 80 per cent was privately financed.

The largest allotments for new facilities were for commodities not ordinarily produced in quantity by these states: (1) guns, ordnance, and

[7] The War Production Board divided the region into 29 industrial districts; of these, 20 received war contracts in an amount at least five times as great as their share of "value added." Eight of the remaining nine got at least twice their proportional share.

explosives, (2) aircraft, engines, and parts, and (3) ship construction and repair.[8] In these categories of war goods the share of these five states represented 44 per cent, 26 per cent, and 15 per cent of the nation's total, respectively. Michigan and Ohio received at least two-thirds of these facilities. Wisconsin's largest item was for shipyards. It seems a little strange that Wisconsin and Ohio should have an important part in the building of ships for ocean service. Frigates, tankers and submarines built in Great Lakes shipyards had pontoons attached to their sterns so as to raise them enough in the water to clear the nine-foot channel to New Orleans, about 1800 miles away. Peacetime tonnage of ships built here is relatively great, but it has been almost exclusively for Lakes traffic.

Between 1939 and 1945 the annual capacity for steelmaking in the United States increased by nearly 14 million tons, or about the same amount as Great Britain's total when war began. The East North Central states accounted for almost half of this increased capacity.[9]

Summary

In contrast with the northeastern states, the East North Central division increased appreciably its share of manufacturing between 1919 and 1939.

The greatest gain was apparent in wages paid and in "value added," generally indicative of a maturing of industry. Michigan and Illinois made the greatest gains; Wisconsin did not gain.

Certain shifts in manufacturing in this division, for the most part taking place since the first world war, in part explain the vigor in the growth of Michigan and Illinois and the lack of it in Indiana, Ohio and Wisconsin.

A major shift was that of the manufacture of farm implements from Ohio to Illinois; another but less important shift was that of rubber tires and tubes from Ohio to Michigan, Indiana, and Wisconsin and to the Gulf and Pacific coasts. Others are indicated by the increased manufacture of steel in Michigan; by the shift of clay manufacturing from Ohio to West Virginia; and of earth-moving machinery from Ohio to Illinois and California.

That Wisconsin should make the poorest showing of the five states may in part be due to the high taxes which Wisconsin manufacturers have long protested. This is a state with only one large city, Milwaukee. This city has declined somewhat in the manufacture of foundry and machine shop

[8] One important reason for Michigan's rôle is explained by the category "ordnance" which included, among other things, motorized combat and non-combat vehicles.

[9] In units of 100,000 tons of steelmaking capacity: Gary district, 24; St. Louis, 1; Cleveland-Youngstown district, 23; Pittsburgh, 29; Bethlehem, 4; Buffalo, 3; Birmingham, 5; Gadsden, 1; Baltimore, 6; Houston, 5; Geneva, Utah, 13; Fontana, Calif., 8; San Francisco, 3; Seattle, 2; Pueblo, 2; Duluth, 3.

products, in electrical equipment, leather, and in clothing.[10] Gains in rubber tires, automobiles and parts, furniture and steel have not been great enough to offset the decline in other Milwaukee industries.

War gave this region the largest share of new plant facilities, but in proportion to the "value added" in 1939, these states were third from the bottom of the list, being greater only than New England and the Middle Atlantic states. Wartime industrial congestion was greater here than in the ten eastern states. There will undoubtedly be more and larger "ghost" plants here than elsewhere in northeastern United States.

West North Central

The West North Central states are not a part of the so-called manufacturing belt. Only eight of the 400 counties in which the nation's manufacturing is concentrated are within this division. The major industries of the region have been those concerned with the processing of agricultural products and the manufacture of iron, steel, and some kinds of machinery.

To students who are inclined toward the view of increasing emphasis upon market-orientation in industrial location, the West North Central states seemed to offer much promise. The per capita consumption of many kinds of machinery, of automobiles, and of many types of creature comforts is exceeded by no other Census division, yet its industrial development has not been great.

1919–1939

Missouri was the only state in the region which increased its share of the nation's manufacturing activity during this twenty-year period. Its increase was manifest on all three bases, number of wage earners, wages paid, and the value added by manufacturing. Nebraska declined most, with Kansas a close second. Iowa and the Dakotas remained virtually unchanged.

This was the period during which marked changes in the localization of agricultural implement, automobile and steel manufacture took place in the East North Central division. To a degree Missouri and Minnesota shared in this development. Steel manufacture came to Kansas City, and St. Louis increased its share; but steel declined in Duluth. Flour milling declined in Minnesota but not in Missouri and Kansas. The trend of shoe manufacture toward the Mid-west was apparently reversed. Early strides in airplane manufacture in this division were not maintained.

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[10] E. M. Fitch and R. L. Curtis. "Industrial Trends in Wisconsin," Dept. of Economics, Univ. of Wisconsin, Madison, 1933, p. 29.

War years

Every state in this division lost population between 1940 and 1944 (Table IV). In contrast with the East North Central states which showed only a slight change in population, these states west of the Mississippi River lost population at a rate much greater than any other Census division.

Although there was a slight decline in population in most of the states comprising the manufacturing belt, that of the West North Central was two to four times as great in proportion to population. The only exception to this rate of decline was in Missouri which lost only 1 per cent of its population.

This appears anomalous in view of public funds spent for new manufacturing facilities. Government financing in this division was proportionately greater than for any state or division east of them. With only 5 per cent of "value added" in 1939, they received 10 per cent of all facilities and 6 per cent of all war contracts. Of this increase and of these contracts Missouri alone got nearly half, with Minnesota and Kansas each receiving 20 per cent.

The war called for a wide range of productive effort in these states. Fifteen thousand miners worked in the iron, zinc, and lead districts. Northern forests produced 92 million board feet of lumber. And 200 industrial plants (and 5 shipyards), 1,500 miles from salt water, made ocean-going tugs, barges, buoys, galley ranges, and ships fittings.

Despite these figures, there seems to be nothing in the changes induced by war to reverse the trend downward of manufacturing in the West North Central division.

South Atlantic and East South Central

These two Census divisions are considered jointly. This is in part due to the equality of their shares of value added by manufacturing, of Government-financed plant facilities, and to the common practice of treating these states as a unit. In general this has not been an important industrial region; only the Baltimore district is a part of the manufacturing belt.

Farther south on the Piedmont is a second industrial area contrasting with any other region in the degree of its specialization. The War Production Board's "Regions and Industrial Areas," a map published in 1943, shows only one district on the Piedmont south of Baltimore. The reason for the omission probably is the narrowly specialized nature of Piedmont manufacturing: cotton textiles, cotton seed products, tobacco, and wood products. In these industries the War Production Board was not particularly interested; metals manufacture was undoubtedly uppermost in their minds.

Although the South Atlantic states did some manufacturing about as early as New England, the boom of commercial cotton production caused industry to lapse for more than half a century. Other industrial districts had developed at Louisville, Huntington, Ashland and Wheeling on the Ohio River; at Charleston on the Kanawha; Memphis on the Mississippi; Knoxville, Alcoa, Chattanooga, and Birmingham in the Great Appalachian Valley; Nashville, and Old Hickory in Tennessee.

Growth in industry, 1919–1939

During this twenty-year period all but two of these southeastern states increased their share of manufacturing. The exceptions were Mississippi and Florida. The states which gained and those which lost did so on all three bases of appraisal. Only California showed a greater proportional gain.

The variety of new industries during this period was somewhat greater in the South Central division. They gained substantially in knit goods, rubber tires, iron and steel, aluminum, machinery and chemical products of several types. The South Atlantic division increased its share of cotton textiles and cotton seed products, iron and steel, wood products including paper, and tobacco manufacturing.

Industrial changes, 1939–1945

During the course of the war, ten of these eleven states gained in population (Table IV). Their proportional increase was exceeded only by the Far West. The one southern state which failed to gain in population was Kentucky.

These southeastern states as a group contributed about 13 per cent of the value added by manufacturing in 1939, and received 16 per cent of all facilities financed by the Government. This rate of financing was comparable to that of the Middle Atlantic division, but the latter lost population while the South gained. As a result of five years of war economy the eastern south finds itself ahead by a large pool of skilled and semi-skilled labor. The net flow of labor to the eastern south reversed the direction of population movement during the twenty years preceding, yet most of the industrial cities between the Great Lakes and the Ohio River were able to undertake war contracts on such a large scale only because of incoming white labor from the hill country farther south.

Wartime employment of these wage earners in the eastern south was in two groups of industries: (1) the old established cotton textile and seed products mills, iron and steel, aluminum, petroleum, chemical and food industries, and (2) in new industries which include ships, planes, rubber, tin, magnesium, ordnance and explosives.

Half of the money spent for new facilities in the eastern south was for shipyards. Whereas in 1939 there were perhaps 28 shipyards and Navy yards in the country, in 1944 there were some 350. The southeastern states received a large share of these yards. In 1939 there were an estimated 7,500 wage-earners in southern yards, while in 1944 there were 200,000.[11] These figures represent almost astronomical increases in this industry.

Although the manufacture of aircraft was an important new southern industry, unlike ships, it constituted but a small part of the nation's total.[12] The assembly of aircraft from parts made by northern manufacturers is an important industry in this area. With the retirement in 1945 of the largest of these northern suppliers, the career of southern assembly centers seems no longer much in doubt.

During the war both the iron and steel manufacturing capacities were increased. The two steel districts (Birmingham and Gadsden) in Alabama show an increase in iron-making capacity of 800,000 tons and in steel of nearly 600,000 tons. Ashland, Kentucky, has increased its iron capacity by 600,000 tons, and the Baltimore district increased iron by 400,000 and steel by 600,000 tons. This in aggregate is a very small proportion of the national increase in capacity.[13]

The largest manufacture of synthetic rubber was at Institute, West Virginia where the alcohol process was first to get into quantity production. Although Birmingham was able to supply certain essential materials for Baton Rouge's growing rubber manufacture, there was no other southeastern contributor.

Freight rates

For many years certain industrial interests in the South have complained about alleged discriminatory freight rates on some classes of freight. In 1943 the Tennessee Valley Authority, attempting to find purchasers for its electricity, likewise sought a change in rates. In June 1945 the Interstate Commerce Commission ordered a 10 per cent reduction on certain types of freight. Although this will probably affect a small part of the freight tonnage, its effect upon the attraction of new industries to these states may be out of proportion to the volume of traffic affected. The prob-

[11] In Mobile there were 50,000 wage-earners in shipwards, in New Orleans, 18,000, Panama City, 13,000, and in Pascagoula, 10,000.

[12] In an industry involving 104 plants with an aggregate industrial floorspace of 171,000,000 sq. ft., these southeastern states have 7 plants with floorspace of 12,000,000 sq. ft. Other Census divisions are: East North Central, 29 plants; Middle Atlantic, 27; Mountain and Pacific, 15; West North Central, 10; West South Central, 9; New England, 5. (Data from *Planes*, February, 1945.)

[13] *Steel Facts*, April 1945, published by the Iron and Steel Institute.

lem of conversion to the needs of peacetime will be acute in this large region, since almost all of their increased industrial activity is concerned with "duration" type goods. Most of these thousands of transplanted wage earners will in all probability, go back to their frustrations on poor hill farms.

West South Central

Between 1919 and 1939 Texas and Oklahoma increased their share of the nation's manufacturing, but Louisiana and Arkansas declined (Table II). Their total output accounted for only 2.7 per cent of all value added by manufacturing in 1939. They included two principal industrial areas, rather vaguely defined: the agricultural-commercial cities of the Texas-Louisiana prairielands which rose to importance with the discovery of oil, and a second dispersed group of port cities on or near the coastal margin.

Beyond the processing of farm products and some machinery manufacture, it remained for the war to give them industrial importance.

Effects of the war

During the years between 1939 and 1945 these states experienced important changes in industry. Texas and Louisiana each gained in population; Arkansas and Oklahoma declined. The rate of gain was exceeded only by the Far Western states. Their share of Government financing of industrial facilities was nearly five times their share of "value added" in 1939. Of this increase, Texas and Louisiana received three-fourths.[14]

These increased wage earners were employed in an expansion of established industries and in some important new ones. An exotic but in the long run minor industry is the tin smelter at Texas City, erected to process Bolivian ores. Another new industry is the steel mill near Houston with a tonnage increase of about 500,000 tons. Nine aircraft plants, with a capacity about equal to that of the southeastern states, have been in production at Fort Worth, Dallas, Houston, Tulsa, and Oklahoma City. As with the plants across the Mississippi, these are primarily bomber assembly plants.

In the rush to secure magnesium for the aircraft industry, the processing plants for this new light metal were built in widely separated parts of the country and in numbers greatly in excess of the ultimate demand. One of the largest of these plants is at Freeport, Texas, where the metal is extracted from sea water.

Large plants for the manufacture of the components of synthetic rubber are located at Port Neches, Velasco and Baytown, in Texas, and Lake

[14] If there is a "new" manufacturing region, it is this part of the Southwest.

Charles and Baton Rouge in Louisiana. Prospects for these oil-product rubber plants are reported to be bright.

Mountain

The mountain division includes the Inter-mountain and the western Great Plains states, a tremendous area. Yet it contributes only 0.8 per cent to the nation's value added by manufacturing. Major districts are: Pueblo, Denver and the Salt Lake area.

1919–1939

During this period the share of the nation's manufacturing contributed by these eight states declined in all but New Mexico, Arizona, and Utah. These three states showed almost no change (Table II).

Among the industries which increased during this period is the manufacture of iron and steel at Pueblo, Colorado, and at Provo, Utah. Both districts use nearby raw materials, and both export a large part of their product to the West Coast cities for manufacture and for export.

Copper refining declined somewhat during these years due to the depressed business conditions, but the Government's policy toward silver tended to keep copper production from the maximum slump.

A large part of Mountain states' manufacturing is concerned with food processing (flour milling, sugar refining, canning, meat packing), industries which showed the minimum of depression slump, so the showing of the inter-war period is, on the face of it, surprisingly good.

1939–1945

Between 1939 and 1944 every Mountain division state gained in population except Idaho and Montana. In the other states the rate of gain was relatively high (Table IV). Mining rather than manufacturing was the cause of this increase. Utah, with a population increase of 15 per cent, had the greatest increase in manufacturing.

The proportion of Government financing of new facilities was high, 5 per cent, and the award of war contracts was correspondingly high. Largest of these facilities is the Geneva steel plant near Provo, Utah, where three blast furnaces were built to produce 1,150,000 tons of pig iron, nine open hearth furnaces to pour 1,283,400 tons of steel ingots, and two rolling mills to produce 700,000 tons of plate and 200,000 tons of structural shapes yearly.

This plant depends for ore upon Iron Mountain, 260 miles south, and upon the Mountain fields for coal, 130 miles east. Production during the

war was designed for the ship and aircraft industries of the West Coast. This very modern plant is now being discussed as a post-war operating unit. With Pueblo and Fontana, it is one of only three large steel plants for the entire western half of the United States. Thus far manufacturing costs per unit of product are lower for the Geneva plant than for the new one at Fontana. Only the Birmingham, Alabama, plant has lower costs.[15]

The effects upon the rural community of Provo (population 18,000) may be imagined; although operating on only two shifts, there are six thousand workers employed in this plant.

Another new industry in this division is the production of magnesium at Las Vegas, Nevada. This basic magnesium plant is reported to be the largest in the United States. Pilot mills were operated at several places in these states for processing various ores in which the United States had been dependent upon imports. Post-war planning does not seem to include any of these plants. Large ordnance and explosive plants were operated near Denver, Salt Lake City, and Idaho Falls during the war. Denver manufactured a variety of parts and fittings for ships.

Prospects

Few districts in the United States have aroused more discussion for the post-war period than the Geneva steel plant and the markets for its products on the West Coast. The plant is operating efficiently now; western rail rates have been cut 10 per cent; important shifts in population have come to the western states. This plant may stay in operation after converting for the steel products needed in peacetime.

Pacific Coast

For many years the Pacific Coast cities were called warehouses for eastern manufacturers. Only the simplest types of manufacturing took place anywhere on the Coast. Like the southeastern Cotton Belt almost a century earlier, agriculture was dominant, and a profitable dominance it was. It furnished one of the bases for manufacturing, and the processing of agricultural products has continued as an important industry.

Although Los Angeles brought in water from the eastern slopes of the Sierra Nevada Mountains early in the present century, industrial development was meager until World War I. The greatest single impetus to West Coast manufacturing was the great petroleum development. Lacking petroleum or an equivalent resource, the Pacific Northwest did not undertake much manufacturing for another quarter century.

[15] Fortune Magazine, February, 1945.

1919–1939

This period witnessed an increase in the manufacturing activity of California and Oregon, while Washington declined on all three bases (Table II). The most vigorously growing cities in the United States, after the automobile boom days, were the California port cities. Bonneville, Shasta, and Grand Coulee dams have fundamentally changed the outlook for industrial development.

New industries in California during these years included the manufacture of rubber tires, automobile parts (seventh among the forty-eight states), earth-moving machinery, sugar and oil refining, rice milling, fruit and vegetable canning (third in the nation), aircraft, furniture, and oil-well machinery.

In the Pacific Northwest industry remained relatively simple in type: wood products, seafood, fruit and vegetable processing, wool, and a little iron and steel manufacturing. The airplane industry of World War I struggled through the lean years until rearmament in Europe gave it a new lease on life.

California rose from tenth to ninth place in amount of wages paid, from eleventh to ninth in number of wage earners, and remained eighth in value added by manufacture. Washington and Oregon declined (Table II).

1939–1945

All three Pacific states gained substantially in population between 1939 and 1944. California experienced the greatest numerical increase in the nation, 1,559,135, and the fourth largest proportional gain, 22 per cent (Table IV). California's war contracts were exceeded only by those of Michigan and New York.

Eighty per cent of California's war contracts were for aircraft and ships; an even higher proportion was for these two items in Washington. Ninety per cent of Oregon's contracts were for ships. Diversification in manufactures was much greater in California than in either of the other two Pacific states.

As for new industrial facilities financed by the Government these states received 8 per cent, half again as great as their share of the nation's "value added" in 1939. Among the new industries in California thus financed were the following:

Magnesium reduction, using both dolomite and sea water; iron and steel furnaces and rolling mill, 675,000 tons capacity (using ore from Sunnyside, California, and coal from southern Utah), cement, shipyards, aircraft, machine shops and tool plants.

The industrial districts of Oregon are near enough to those of Washington to be treated here as one region. New facilities in these two states are about half those of California and were principally for ships, aluminum (one-half U. S. capacity), and aircraft manufacture. The shipyards are to Portland what the aircraft industry is to Seattle.

The Pacific Coast attracted labor from nearly every state in the country to man these tremendous increases in industrial capacity.[16] Most of the manufactured products are clearly for war purposes, but California especially, sees in this phenomenon an important step in the evolution of her economy. Some of these observations follow:

The gains in her manufacturing efficiency may augur much for peacetime industry.[17]

There is reported to be ample scrap iron and steel for the industry's anticipated need. Although the ore and coal must move about 700 miles to the Fontana plant, the unit cost in 1945 is not out of line. Steel demands include the manufacture of tin plate for the food industry, some part of the new aircraft industry, earth-moving and oil-well machinery, pipe, possibly bodies for automobiles and refrigerators, and exports for the Oriental market appear to be important.

The proportion of United States trade with western Europe has been halved during the past sixty years, while that with Asia has doubled. Although New York handled almost as much of the Oriental trade as San Francisco, the bulk of this trade passes through our West Coast ports. Granting a continuance of a substantial part of our merchant marine, West Coast shipyards may well constitute a market.

Despite the induction into the armed services of about 11 million men, the growth of nearly all American cities, especially those on the West Coast, has been startling. California has about 1½ million more civilians. This

[16] Origin and number of west coast arrivals:

West North Central	1,442,000
East North Central	940,000
West South Central	595,000
Mountain	560,000
Middle Atlantic	379,000
East South Central	170,000
South Atlantic	138,000
New England	134,000

[17] All West Coast aircraft plants in December 1940 employed about 90,000 wage earners and built 2600 planes; this is a ratio of 31 to 1. By December 1941 this ratio was 22 to 1. In December 1942 the ratio was 16 to 1. And in 1943 it was 11 to 1.

The Fontana steel plant in late 1944 was operating at 115 per cent of its rated capacity, according to Fortune, Feb. 1945.

makes a big increase in the local market for all kinds of consumption goods. These are the sorts of factory goods for which the West has heretofore been dependent upon the northeastern states.

Doubtless there has been some rationalizing of emergency industrialization. Economies in production have been worked out. Strong communal ties may have developed. Functional efficiency may result in functional prestige. These are factors to be considered in locating industry.

But from the appraisal of the changes noted, the centrifugal forces which have brought it about have little evidence of permanence. The strongest forces have been centripetal, and the expanded pattern of manufacturing distribution is for the most part temporary. The principal exceptions are on the West Coast and the Southeastern states where the trend is toward increased manufacturing.

Conclusion

Although concentration of manufacturing persisted between 1919 and 1939, there were some important changes in its geographical distribution. The eastern part of the area of concentration declined, relatively, in its industrial productivity. The rate of decline was equaled by one other division, the Mountain states. The only northeastern states to stand out against this trend were Connecticut and New Jersey.

The western part of the area of concentration gained somewhat, both absolutely and relatively, during this period. The most vigorous growth was experienced by Michigan and Illinois. Within this East North Central Census division there were important shifts of industries which largely accounted for the changing positions of certain states.

Outside of the so-called manufacturing belt, gains were made in the southern states, with the exceptions of Mississippi, Arkansas, Louisiana, Florida, and Delaware. Only Texas and California exhibited gains as substantial as those of the southeastern states.

The second world war put a great deal of industrial capacity in the Pacific and southern states, but a very large part of it is for "duration" type goods. In the main, Government financing of manufacturing did not profoundly affect the pattern of manufacturing in the United States.

Geography in Off-Duty Educational Opportunities for Armed Forces

ALICE FOSTER*

In this report I wish to share with other geographers the experiences and information which I gained in working with the Examinations Staff for the United States Armed Forces Institute during part of 1944. Probably the off-duty educational facilities provided by the Institute for service personnel at home and overseas are less widely known to geographers than are the formal programs set up as training for special branches of service, such as the Preflight, Premeteorological, and Army Specialized Training programs. Particularly, however, I am interested in passing on what I learned about recent advances in the theory of testing and about the applicability of modern techniques to testing in the field of geography at the college level.

SCOPE OF ARMED FORCES INSTITUTE WORK

The United States Armed Forces Institute (USAFI), an official agency of the War and Navy departments, is concerned chiefly with off-duty educational opportunities for service men and women who wish (1) to increase their efficiency as members of our Armed Forces, (2) to prepare for postwar civilian jobs, (3) to continue an educational program interrupted by military service, or (4) to satisfy a personal interest in some subject. The Institute is interested also in facilitating academic credit for educational achievement during military service, however achieved; and in harmony with this interest, it has worked out a comprehensive testing program.

The educational program of the Armed Forces Institute is planned to operate under the varied conditions experienced by our fighting forces, whether in training camps at home or in combat areas abroad. In general, it provides for long-distance instruction (1) by offering correspondence courses, (2) by providing textbooks, outlines, and other aids for individuals or groups wishing to study independently, and (3) by arranging for the organization of classes under the best available leadership. Geography is offered under each of the three plans.

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* Dr. Foster writes from a background of much experience in educational methods in geography and in the teaching of geography to Armed Forces personnel. During the war she was instructor in the Premeteorological Program at the University of Chicago and later was subject matter consultant for the Armed Forces Institute.

In March, 1945, I had opportunity for brief contact with the work of the USAFI at the Yuma (Arizona) Army Air Base. A library of some 4,000 volumes has been built up, the attractive and comfortable reading room being generously supplied with newspapers and magazines. The well-trained civilian librarian in charge stated that the reading room is filled to capacity during both daytime and evening hours, and that normally only about half the books are on the shelves, the other 2,000 being charged out. The officer in charge of the USAFI educational program at the field is genuinely interested in educational work and in the men. Some 75 to 90 classes are scheduled, and a goodly number of men are carrrying correspondence courses. Mathematics and German are popular subjects, both for class work and for correspondence study. No geography classes are scheduled, but judging from the collection of maps displayed at the Service Club, together with the educational director's interest in the areal pattern of combat areas and his practice of distributing to the barracks up-to-date information along this line, it seems clear that the men are getting some valuable incidental instruction in geography.

Correspondence courses available through the Armed Forces Institute fall into two general groups. First, a member of the Armed Forces may register for work with one of the more-than-eighty colleges and universities that offer correspondence courses through the Institute, receiving lesson service directly from the college or university, and obtaining credit on the same terms as other extension students of the institution. In this case, the cost of the course is shared by student and USAFI. About fifty of the co-operating colleges and universities offer correspondence work in geography—a dozen different courses, most of them at the college level. In the second group are the correspondence courses offered by the Institute itself. The second edition of the USAFI *Catalog*, published in March, 1944, lists 169 courses in academic subjects at elementary (only 4), high school, and college levels, and 104 courses in industrial and technical subjects. Economic geography is included among the correspondence courses offered by the Institute at both high school and college levels, while offerings at the college level also include physical geography and the geography of Europe. In addition, the Institute provides geography courses for self-teaching, at both high school and college levels.

Tests have an important place in the USAFI educational program because the Institute offers accreditation service, though not itself granting academic credit. A certificate is awarded upon the successful completion of an Institute course, and the Institute compiles the educational record of service personnel who use its correspondence-study, examination, or guidance facilities. On request it will make a similar compilation of records

for other service men and women. If a student wishes his in-service experiences translated into academic credit the Institute will, at his request, send to the school of his choice an official report giving all available information regarding his experiences and achievement. While the Institute does not evaluate individual courses in terms of academic credit, it aims to facilitate evaluation by the school to which application is made. For this purpose, the report on an applicant for credit includes a description of each Institute course he has taken while in service, a statement of the course objectives, a summary of each lesson or unit, and the results of any examinations taken.

EVOLUTION OF USAFI TESTING PROGRAM

The testing service of the USAFI was developed as an aid towards the recognition of educational growth during the period of military service, without the inequitable results of the blanket-credit practice which followed World War I. Early in the present war it was recognized that if the former errors were not to be repeated the schools would need to have ready a workable and educationally valid alternative plan. Within a month after the attack on Pearl Harbor, the problem of accrediting was discussed at the Baltimore conference of college and university presidents; and that body voted in favor of basing credit on application by individual men and women to individual institutions, each application to be supported by evidence of competence in such form as the institution might prescribe. The American Council on Education offered its services and called together a committee which met early in April, 1942, and began to formulate plans looking toward (1) equitable placement of service men and women on return to educational institutions, (2) the granting of appropriate credit for educational growth during military service, and (3) the motivation of soldiers' and sailors' educational efforts. The committee recommended, among other measures, the construction of a series of tests to appraise achievement in terms of skills, attitudes, and knowledge. It further recommended that the privilege of taking the tests be open to any service man or woman and not restricted to those registered in Institute courses.

After thorough study of the whole matter by a number of committees, the War Department contracted with the University of Chicago Board of Examinations to prepare the necessary tests for the program. The particular group entrusted with the construction of Institute tests, known as the Examinations Staff for the United States Armed Forces Institute, consists of specialists drawn from the Board of Examinations, from other departments of the University, and from other institutions. Test construction for the USAFI involves the co-operation of many groups, for the educational program deals with many subjects and the tests completed or in

process of construction are numbered in hundreds. Supplementing the work of test authorship are the cartographic, editorial, and printing services. The tests are copyrighted by the American Council on Education, and that body distributes such test forms as are released for civilian use. The Examinations Staff was asked to construct tests of the following types:

(1) *End-of-course tests* in the various subjects at high school and college levels, the objectives and content to be determined by the nature of courses offered by the Institute;

(2) *Subject tests* in the various fields in which the USAFI offers courses at high school and college levels, the objectives and content to harmonize with the minimum essentials of similar courses as offered in high schools and colleges, and these tests to be standardized through the use of alternative forms in civilian classes;

(3) *Tests to measure general educational development* for the purpose of predicting probable future success at various high school and college levels, thus permitting schools to evaluate educational growth as stimulated by experiences other than the study of school subjects;

(4) Tests of competence in certain highly technical fields of special military importance.

Headed by one of America's leading research workers in the field of scientific testing, the Examinations Staff operates under the policy of bringing together, for the construction of tests, mastery of subject matter and command of modern testing techniques, either in a single worker or by means of team work. The services of the subject-matter specialist include (1) a survey of the content of each course and the selection therefrom of material which is essential because of its relation to the course objectives and to the general objectives of the subject, (2) the analysis of the course objectives into elements specific enough to serve as guides in setting up test exercises, and (3) responsibility for the soundness of the test exercises from the subject-matter point of view. To the testing specialist falls the responsibility for an adequate sampling of the material of the course, the selection of test forms, and the creation of exercises whereby the student may demonstrate his progress towards the course objectives.

In the field of geography the Examinations Staff planned to set up (1) end-of-course tests for the correspondence and self-teaching courses offered by the USAFI and (2) a subject test for introductory geography at the college level. There was a long delay in starting work on the geography tests, due to the difficulty of securing the services of a subject-matter specialist. The need for geographic knowledge in planning war strategy called many geographers to Washington early in the war, and the geography re-

quirements in Army and Navy educational programs taxed to the limit the depleted teaching staffs of universities and colleges. In January, 1944, I was released from work with the Premeteorological Program to assist in preparing tests for the geography courses in the Army Specialized Training Program, acting at first as subject-matter consultant, and later taking full responsibility for the alternative form of the ASTP geography tests. When this work was completed, I undertook the preparation of geography tests for the USAFI. Of the geography tests contemplated, only the end-of-course tests were completed. Some preliminary work was done on the subject test, but before the preparation of the test got under way the test-construction program of the USAFI was terminated abruptly.

MODERN TESTING TECHNIQUES AND THEIR APPLICABILITY TO GEOGRAPHY

During the last three or four decades, much attention has been given in American institutions of higher learning to the whole problem of evaluating student achievement. In its early stages the movement to improve examinations was stimulated by a recognition of the extent to which the scoring of student papers depended on individual opinion as to reasonable standards of excellence. Gradually a theory of testing developed, based on the fundamental principle that examinations should measure progress toward definitely stated objectives. Advance toward this ideal has been slow, for test improvement must go hand-in-hand with clarification of objectives.

Efforts to build satisfactory tests of accomplishment have been directed along two distinct lines—the improvement of the traditional essay-type examination and the development of "new-type" techniques. In the first line, examiners have tried to improve the type of question so as to provide better opportunity for students to demonstrate progress toward general objectives. Work along the second line endeavors to analyze general objectives into their component elements and to measure progress toward each specific objective separately.

Traditional-type examination practices at the college and graduate levels have been subjected to numerous experimental modifications designed to throw more emphasis on ability to use and correlate knowledge. Typical of this trend are the senior examinations given in many Eastern universities and colleges, which are charaterized by questions of large scope, and which in some cases are "externalized" by making an outside committee responsible for both questions and scores. Another attempt to free essay-type examinations from undue emphasis on memory is the practice of including in a course examination one question announced in advance, or the comparable practice of permitting access to sources during the examination

period. An outstanding example of departure from tradition in this general line is the field problem which forms part of the preliminary examination for the Ph.D. degree in geography at the University of Chicago, a problem which requires the candidate to make an independent survey of a small assigned area and present a written report of findings.

New-type examination techniques have advanced far since the appearance of the much abused true-false test, and they no longer are restricted to probing for memory of factual detail. Instead, they are being adapted for a widening variety of special purposes, as evidenced by the practice of giving a battery of aptitude and placement tests and vocational preference questionnaires to entering college freshmen for the purpose of strengthening guidance programs. The geography committee that worked under the Commission on the Social Studies in the early 1930's[1] demonstrated the feasibility of using new-type techniques to test mastery of regional concepts and to measure skill in map-reading. Other workers have devised ways of testing ability to apply geographic principles or generalized geographic knowledge in new situations.

The use of new-type examinations in geography and other academic subjects at the college level represents a relatively recent stage in the evolution of modern testing techniques. As in the case of nearly all movements for educational betterment, experimentation with new-type tests began in the elementary grades rather than at higher levels. Psychologists and statisticians were responsible for most of the early work, and emphasis was principally on measurement techniques, with little attention to soundness or adequacy from the subject-matter point of view.[2] An important contribution of the Kelley-Krey Committee on Tests and Measurements in the Social Sciences, which began its work in 1929, was to bring people interested primarily in subject-matter and teaching into contact with testing experts for purposes of discussion and experimentation. In the college field a few experimental testing projects had been started before 1929, and interest increased during succeeding years. At the Syracuse meeting of the National Council of Geography Teachers in 1936, Ralph Brown reported on the construction of new-type course tests in geography at the University of Minnesota as part of a comprehensive experiment directed by the Committee on Educational Research of that university.[3] Under the committee plan, test construction was accomplished through the cooperation of the

[1] Kelley and Krey, *Tests and Measurements in the Social Sciences*, Pt. IV of the Report of the Commission on the Social Studies, Charles Scribner's Sons, 1934.

[2] Kelley and Krey, *op. cit.*, pp. 1–3.

[3] Journal of Geography, April, 1937, pp. 140–148.

course instructor, a testing expert who acted as counselor, and a testing assistant who was responsible for most of the actual work of test construction and who attended all meetings of the class.[4] The Institute for Administrative Officers of Higher Institutions devoted its 1936 session to the general theme of Tests and Measurements in Higher Education. Reports presented at the Institute indicate widespread interest in the improvement of examination techniques at the college level, with a few universities actively exploring the possibilities of the new-type techniques. The Proceedings of the Institute also show an inclination on the part of leaders in the testing movement to consider critically both the strength and the weakness of existing or proposed examination practices.

Leaders in the field of tests and measurements agree that a balanced program of essay-type and new-type examinations is better than the exclusive employment of either, since each type has its own advantages and its own limitations. The essay-type examination excels in possible scope, in opportunity for student initiative, and in demand for sustained thinking and effective presentation; but evaluation of results is laborious, and no way has been found to secure uniformity in scoring. The new-type examination has the advantage of definiteness in question, in response, and in scoring. It excels in the quantity of subject-matter that can be sampled in a short examination period and in the rapidity with which the papers can be scored. The possibility of standardization gives it special value for comparison of educational achievement under different conditions. It probably is superior as an instrument for detecting specific weaknesses that call for modifications of teaching techniques. Its chief limitation lies in its restriction to testing for fragments of learning and its inability to reveal comprehensive mastery of a subject. Because it does not demand sustained thinking and convincing presentation, its exclusive use may have serious effects on students' study habits. A practical disadvantage lies in the time and technical skill required for test preparation. The structural simplicity of a good new-type examination makes the task of exercise construction appear deceptively easy, and subject-matter departments may well question the wisdom of adopting new-type techniques unless generous expenditures of time and adequate counseling service by testing specialists are feasible. A hastily prepared new-type test is likely to be as bad as the poorest essay-type examination, or even worse.

The various examination types and test forms differ in the degree of

[4] William S. Gray (editor), *Tests and Measurements in Higher Education*, Vol. VIII of Proceedings of the Institute for Administrative Officers of Higher Institutions, 1936, pp. 29–30. University of Chicago Press, 1936.

learning called for. Of the two commonly used new-type test forms, the direct-answer form requires a higher degree of learning than does the truly objective multiple-choice form, just as it requires a higher degree of mastery to write a foreign language than to read it. The essay-type examination at its best demands a still higher degree of learning, since it requires not only independent recall but also critical judgment in marshaling facts and ideas for the development of a theme or the defense of an opinion.

The USAFI has built up, through the work of the Examinations Staff, a large collection of new-type examinations in many subjects, including geography, at the high school and college levels. The magnitude of the USAFI program precludes the use of any test form not suitable for machine scoring. This restriction means that each exercise calls for choice among the possibilities presented by a list whose length depends on the type of answer sheet to be used. Generally four or five choices are given, but the number may be as high as fifteen. Though rigid in some of its requirements, the machine-scored test admits of considerable variety in kind of exercise and kind of mental activity called for. Possibly the USAFI examinations may be made available at some future time for civilian use, and it is to be hoped that they may serve as a foundation for further experimentation in the application of modern testing techniques to geography.

In order that examination results might be as concrete and intelligible as possible, the Examinations Staff requested that exercises be classified on the basis of objectives, and that they be grouped into sections accordingly. Some of the sectional divisions used in the end-of-course tests are (1) Reading of maps and graphs, (2) Command of technical vocabulary, (3) Familiarity with elements of world pattern appropriate to course, (4) Acquaintance with commercial products and their uses, (5) Grasp of principles and ability to apply them in specific cases. Division into sections based on course objectives permits partial scores of a descriptive nature. A comparison of partial scores with proficiency standards set for the various sections might show, for example, that a student could read maps and graphs intelligently and accurately, but that he lacked an adequate concept of world pattern.

A major difficulty in the way of constructing effective new-type geography examinations at present grows out of the vagueness with which objectives ordinarily are stated. In order to serve as reliable guides either for test construction or for teaching, objectives need to be expressed in terms of what, as a result of instruction, the student should be able to do. But there is no general understanding as to what shall be the responsibility of each educational level for developing specific abilities and skills; and ordi-

narily the objectives of individual college courses are equally vague. For example, the declared objective of one Institute course is to "teach the student the facts of commercial geography and to help him understand the reasons for the concentration of raw materials and products at certain places." Starting with this general statement, the testing staff must try to discover, through a survey of the text-book and the correspondence manual, what facts of commercial geography belong to the minimum essentials of the course, what raw materials and products are to be considered as having major importance, what kinds of concentrations are to be interpreted, how penetrating the student's interpretation is expected to be, what principles he should be able to command, and how much skill he is expected to display in their application. It is necessary to inquire also what skills in the use of geographic tools (maps, graphs, pictures, statistical tables) are implied, though not stated, in the objectives; and to ask what specialized terminology the student is expected to make his own. The difficulty is aggravated by a corresponding vagueness as to what abilities and skills the student is expected to bring to the course from previous experiences. If the guess of the testing staff on these questions should not harmonize with the opinion of the instructor, the results may be somewhat unhappy for the student.

NEW-TYPE TEST FORMS ADAPTED TO USE IN GEOGRAPHY

Among the many varieties of exercise suitable for use in new-type geography tests are (1) simple multiple-response questions, (2) matching exercises, (3) completion exercises, (4) modified true-false exercises, (5) exercises calling for order in a series, and (6) exercises calling for comparison of paired items. This list does not exhaust the possibilities, and a single kind of exercise may be used to test accomplishment in different lines, such as command of vocabulary, map-reading skill, and ability to apply principles. Examples of these exercises, as given below, are set up for machine-scoring with an answer sheet that permits a maximum of five choices. A number of them might be put into the less objective but more searching direct-answer form. The examples given do not represent new-type testing reduced to lowest terms, since in most cases a single exercise touches upon more than one specific objective. For example, the second exercise calls for the application of a principle, but the principle must be recognized as consisting of two parts which are to be applied separately. Furthermore, if the student is to be sure of his ground he must know something of the pattern of land and water in Europe, since the correct answer would be a different one if the latitude were such as to place Station II on the shore of the Mediterranean.

Examples of Simple Multiple-Response Exercises

1. Which of the terms listed in the opposite column is correctly applied to the dreaded funnel-shaped "twister" that sometimes causes great destruction within its narrow path across part of some Middle Western state?

A) Anticyclone
B) Cyclone
C) Hurricane
D) Tornado
E) Typhoon

2. Stations I and II are in Europe, at approximately 50° N. Station I is on the west coast, Station II about 1500 miles farther east and at an elevation of less than 500 feet. How do summers and winters at Station I probably compare in temperature with those of Station II?

A) Summers hotter, winters warmer
B) Summers cooler, winters warmer
C) Summers hotter, winters colder
D) Summers cooler, winter colder
E) About the same as at Station II

Matching Exercise

The matching exercise becomes increasingly difficult, without necessarily losing objectivity, when an increase is made in the number of items to be matched. In the exercise given below, the student is expected to make application of generalized knowledge concerning the relation between vegetation and soil type, and also to draw upon his knowledge of the vegetation pattern of the United States.

Match vegetation and soil types by selecting from the list in the opposite column the soil type characteristically formed under each of the following vegetation types.

3. Coniferous forest of North Carolina coastal plain
4. Long grass of Iowa and central Illinois
5. Oak-hickory forests of Indiana
6. Pine forests of northern Minnesota
7. Short grass of eastern Colorado

A) Brown steppe soils
B) Gray-brown podzolic soils
C) Lateritic red and yellow soils
D) Podzols
E) Prairie soils

Completion Exercise

For each of the partial statements below, select from the second column the expression that best completes the statement.

8. Cattle grazing on wild vegetation are not a common sight in the Yuma area of southwestern Arizona, because there the

9. Corn (maize) is not a successful crop in England, because there the

10. Many people spend their summer vacations in northern Maine, because there the

11. The climate of Southeastern United States favors the cotton harvest in that the

12. Rice culture on drained lake beds in central Minnesota probably would not be profitable because there the

A) autumn is less rainy than other seasons.
B) average annual rainfall is less than 5 inches.
C) frost-free season is less than 5 months.
D) ground is frozen during several months in most years.
E) summers are mild rather than hot.

Modified True-False Exercise

Classify the statements below by reading the official Daily Weather Map for December 12, 1939.

Mark answer sheet
A) if map proves statement to be true;
B) if map proves statement to be false;
C) if map suggests but does not prove that statement is true;
D) if map suggests but does not prove that statement is false;
E) if map gives no evidence either for or against truth of statement.

13. December 12, 1939, was colder at Chicago that at Des Moines.

14. At Nashville (Tennessee) in 1939, December 13 was warmer than December 11.

15. On December 12, 1939, the barometric pressure was lower at Port Arthur than at Duluth.

16. On December 12, 1939, San Francisco was free from fog all day.

Exercises Calling for Order in a Series

By comparing the time of sunrise, determine the latitudinal order of the five stations listed in the second column of the exercise below.

	Station	Time of Sunrise December 21st
17. Which is the most southerly of the five stations listed in the opposite column?	A) Akyab	6:30 A. M.
18. Which of the stations is second from the south?	B) Coruripe	5:40
19. Which is the most northerly of the five stations?	C) Oslo	9:02
	D) Serena	4:59
	E) Troy	7:18

Comparison of Paired Items

Compare the items of each pair below, marking answer space
A) if first item is greater than second;
B) if second item is greater than first;
C) if the two items are approximately equal;
D) if relative magnitude of items is not constant.

20. Noonday elevation of sun above horizon at Buffalo on March 21
Noonday elevation of sun above horizon at Buffalo on June 21

21. Number of continuous daylight hours at equator
Number of continuous daylight hours at Montreal

22. Probability of frost at Richmond, Virginia, 90 days after winter solstice
Probability of frost at Richmond, Virginia, 90 days after summer solstice

REPORT OF UNFINISHED SUBJECT TEST IN INTRODUCTORY GEOGRAPHY

Since standardization permits a Committee on Evaluation to recommend a definite amount of credit for individuals meeting the proficiency standards set for a subject examination,[5] it is unfortunate that the subject test in introductory geography at the college level could not have been completed. Because of the diversity of the introductory courses offered, the construction of a single subject test promised to be a difficult matter. However, there seemed to be a possibility of so selecting and classifying test exercises that sectional scores would permit recommending a year's credit for satisfactory performance in the whole test or a lesser amount of credit in physical or economic geography, according to the sections handled successfully. In accordance with the regular procedures of the Examinations Staff, our plans for the development of the subject test included the following steps.

1. Questionnaire to get general information regarding the nature of the introductory course in various colleges and universities
2. Survey of textbooks mentioned most frequently in response to questionnaire, listing topics treated in each textbook.
3. Compilation and condensation of topics into list of manageable length for second questionnaire intended to sample opinions as to minimum essentials of an introductory course
4. Analysis of results and translation into course objectives
5. Construction of test in preliminary form, probably with more than the necessary number of items

[5] *Guide to the Evaluation of Educational Experiences in the Armed Services*, distributed from 363 Administration Building, University of Illinois.

6. Submission of preliminary test to consultants in field of geography
7. Revision in light of consultants' criticisms, eliminating or reconstructing unsatisfactory exercises
8. Tryouts with classes of civilian students to the number of several hundred near the close of the first semester of the 1944–45 academic year
9. Revision in light of try-out results
10. Second tryout near end of academic year 1944–45 with at least 1000 civilian students, followed by establishment of proficiency standards on basis of tryout results
11. Final printing of two alternative forms, one the secret Armed Forces form, the other for civilian use

The plan was carried through the first three steps.[6] The first questionnaire was sent out at the end of June, the second in early October. Response to both questionnaires was excellent. Before all returns were in, the Examinations Staff was notified that it would be necessary to terminate the test construction program at the end of November. While it might have been possible to get the test into preliminary form by that date, the time was altogether too short to permit of standardization. Therefore the project was dropped. It seems to me, however, that geographers will be interested in knowing something of questionnaire returns and the status of the unfinished project.

A preliminary survey of questionnaire returns indicates that introduction to geography at the college level is offered through three general phases of the subject—physical geography, economic geography, and a third type of course listed under such names as *Principles, Elements,* or *World Geography.* In addition, there are some schools that make geology a prerequisite for geography courses, with or without an introductory course in geography to follow. It should be borne in mind that only a sampling of policies and practices was attempted and not a complete survey. Furthermore, it was not possible in all cases to separate data concerning military classes from those referring to regular college classes.

The most widespread practice, particularly where introduction to the subject consists of a single one-term or one-semester course, is a survey aiming to build up a rationalized concept of the fundamental physical and cultural elements of world pattern. The principles necessary for an initial interpretation of distribution patterns commonly are developed through a study of life in contrasted regions, through presentation in an introductory section of the course, or by a combination of the two schemes. This group

[6] Miss Harriet Carter gave valuable assistance in this early work on the subject test.

of courses, lacking an accurately descriptive name, will be designated "World Geography" in this report. In a smaller number of schools, the introductory course in World Geography covers two terms or two semesters.

Next in numerical importance is the group of schools that offer physical geography as the introductory course or else make geology a prerequisite to the study of geography. In the majority of these schools a one-semester or one-term course in physical geography is followed by a course in economic or "world" geography. Most of the others follow a full year of physical geography or geology with offerings of geography courses placing more emphasis on life phases of the subject, with or without a geography course intended to be definitely introductory.

The preliminary survey of questionnaire returns gives economic geography third place among introductory courses in geography at the college level. However, the term *economic geography* is used rather loosely to indicate either a course dealing with the production of specific commodities or a quite different course which inquires how people wrest a living from the earth in contrasted regions. The latter type of course might well be considered as belonging to the "world geography" group. Data are not sufficient in many cases to permit accurate classification of courses listed as economic geography.

The purpose of the above-mentioned questionnaires was to find out whether the various introductory college courses in geography have something in common. Questionnaire returns seem to justify an affirmative answer, though the evidence is not altogether conclusive. Returns suggest also that underlying the diversity in choice of material and avenue of approach there may be considerable agreement as to course objectives, particularly as to objectives concerned with principles and their application. Further investigation is necessary if the area of agreement is to be identified with sufficient accuracy to serve as a sound basis for test construction. Another sampling questionnaire is needed, and possibly more than one, if the project is to be advanced further. I am convinced that geography definitely needs more work along this line, at least to the extent of analyzing objectives. Whether there is need for a standardized test may be questioned, since the test could not have a place in the USAFI program at this late date. The success of the project in its early stages was due in large part to the prestige and financial support of the USAFI. I believe that further success would be probable if the project were to be continued with the joint sponsorship and financial support of the Association of American Geographers and the National Council of Geography Teachers.

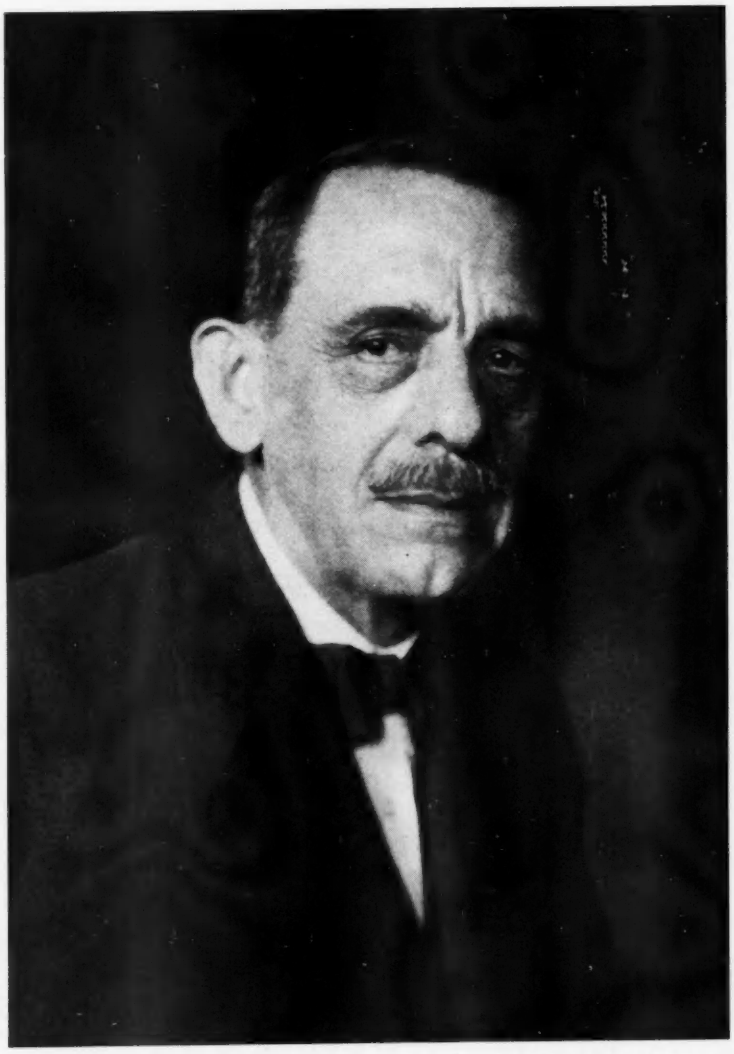

Photo by Nancy Ford Cones

NEVIN MELANCTHON FENNEMAN, 1865–1945

Memorial to Nevin M. Fenneman

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On July 4th, 1945, one of America's great geographers and teachers, Dr. Nevin M. Fenneman, Professor Emeritus of Geology at the University of Cincinnati, died at the age of 79, after an illness of about six weeks.

Until late in May, Dr. Fenneman had retained his usual physical and mental vigor and was busily engaged in the preparation of the essays on educational and philosophical subjects to which he had devoted much of his time in the later years since completing his major geographical works.

Nevin M. Fenneman was born at Lima, Ohio, on December 26, 1865, son of William Henry and Rebecca Oldfather Fenneman. His father was a minister of the Reformed Church in America, whose family came from the low countries somewhere near the Westphalia-Holland border. In 1883, before reaching the age of 18, Fenneman graduated with the A.B. degree from Heidelberg College at Tiffin, Ohio, and in 1901 received the Ph.D. from the University of Chicago. In the meantime he taught in high schools for a few years, then served from 1892 to 1900 as Professor of Physical Sciences at Colorado State Normal School, where Geography was one of his principal subjects. We have record that the summer of 1895 was spent in study with Professor W. M. Davis' summer class at Harvard. This was the beginning of a life-long friendship with Davis.

After receiving his Doctor's degree from Chicago, Fenneman became the first Professor of Geology at the University of Colorado, in which position he remained for three semesters in 1902 and 1903. He then accepted a professorship at the University of Wisconsin, which he held for four years before being called, in 1907, to the University of Cincinnati to found a Department of Geology and Geography. At the beginning, Dr. Fenneman was the only member of the Department. The next year J. Ernest Carman was employed as an instructor, and subsequently others were added as the Department grew in numbers and influence. In 1937 he became Professor Emeritus, but continued to give his advanced course on the Physiography of the United States until a year before his death.

During the years from 1901 through 1924 Fenneman worked at various times as Assistant Geologist, Associate Geologist, and Geologist on the United States Geological Survey; and as Geologist on the Wisconsin Geological and Natural History Survey, the Illinois State Geological Survey, and the Ohio Geological Survey. Many of his earlier publications record the results of summers spent in the field for these organizations.

It happened that his return to Colorado as Professor of Geology followed by only a few months the beginning of development of oil in the Boulder district only a short distance from the University. Fenneman was asked by the United States Geological Survey to make a study of the new field. This assignment apparently occupied the summers of 1902 and 1903. The summer of 1904 was spent under the auspices of the U. S. Geological Survey in a study of oil fields on the Gulf Coast, that of 1905 in the Yampa coal field of Colorado, and that of 1906 under the combined auspices of the United States and the Illinois State geological surveys on the geology and physiography of the St. Louis quadrangle.

After he moved to Cincinnati, field work was continued under the auspices of the United States Geological Survey during the summers of 1909–1911, 1913, and part of 1914, in mapping the Pleistocene and economic geology of the four adjoining quadrangles centering near Cincinnati. This work was originally planned for publication as part of the projected U. S. Geological Survey folios covering the Cincinnati region. Though these folios never appeared, the principal results of the work were published in 1916 as a Bulletin of the Ohio Geological Survey under the title "Geology of Cincinnati and Vicinity." That report covered the bedrock geology, physiography, glacial geology, and the economic resources of the region, but the physiography received the most detailed treatment, and the report still remains the best account of the physiography of the Cincinnati area.

All this field experience in diverse and widely separated areas helped to lay a broad foundation for Fenneman's future work and resulted in several Survey bulletins and other publications, mainly of a geological nature, which appeared in the period 1903–1911. In these earlier years, however, we find several analytical papers of a physiographic nature as well as others foreshadowing his future interest in more strictly geographical and in educational problems.

At about the time of the completion of the field work in the Cincinnati region, events began to shape so as to direct Fenneman's energies into what was to become his principal life work—the regional physiography of the United States. The interest in regional geography was not, however, a new acquisition. In a paper prepared in 1938, when he was awarded a gold medal by the Geographical Society of Chicago, Fenneman says of his going to Chicago in 1900 for graduate study:

> Though classed as a student of geology, I came to this University by way of geography, having been for some years a teacher of that branch in the State Normal School of Colorado. Geography was my calling and my goal. . . . When, after taking my doctorate in geology, I went back to teaching . . . I was disturbed by the half-conscious feeling that to explain processes and type forms, even with stock illustrations,

was not quite enough to meet the needs of the case. Everywhere in that great and diversified state, topographic forms seem to stand up and shout,—How do you classify me? Where do I belong and what do I illustrate?—In other words, the obligation to explain the actual spot seemed quite equal to that of elucidating and illustrating the principles.

The event leading to the transition from dominantly geologic and physiographic work to the study of physiographic regions, and to regional geography in general, is well described by Fenneman later in the same paper:

In the years following 1911 the growing tendency among geographers to show the connection between human activities and their physical basis caused the Association of American Geographers to take an active interest in the critical systematizing of divisions and subdivisions and in delineating their boundaries as accurately as possible, even when they must be arbitrary.

At the Chicago meeting of the Association in December, 1914, it was decided to appoint a committee of five to study the subject and prepare a new map. It fell to my lot to be chairman of that committee . . . I obtained leave of absence from my professorship for the year 1915–1916, went to Washington, and devoted the year to the work of the committee.

This was the turning point. It led to the preparation of the map and papers on "Physiographic Divisions of the United States," and thence directly to his major work, the two volumes, "Physiography of the Western United States" and "Physiography of the Eastern United States."

The two papers, "Physiographic Boundaries within the United States," published in 1915, and "Physiographic Divisions of the United States," published first in 1917 and twice re-printed (the last time in revised form in 1928), were the results of painstaking work on the part of the chairman and his committee working in closest cooperation with the United States Geological Survey. As Fenneman writes:

The committee's map and classification of divisions and subdivisions were at once issued as a public document and adopted as the frame of reference to which physiographic chapters in the Survey's publications should conform and by which editing should be guided.

From the first, Fenneman had in mind the correlation of physical environment with human and economic distributions, and he realized that for this purpose it would be necessary to substitute for the actual physical boundaries the nearest political boundaries used by the census.

"In order that these substitute boundaries may approximate the physical lines as closely as possible, they should be traced on a map showing the smallest political units in use," i.e., the township or other smallest divisions used by the census. Having the physiographic boundaries so outlined, he envisioned the tabulation of census material by natural divisions instead of by states and counties alone.

The two volumes of the Physiography of the United States, which undoubtedly constitute Fenneman's crowning achievement, are much more than a compilation of pre-existing knowledge. For each physiographic region the author drew upon all available topographical and geological maps and written material. All of this was then analyzed and synthesized into a carefully-prepared word picture of the region, but in instances where differences in interpretation could not readily be reconciled on the basis of present knowledge, Fenneman was careful to present the divergent views for the benefit of future students—generally without himself taking a definite stand on the question at issue.

In undertaking the work, Fenneman seems to have had in mind summarizing and analyzing the existing scattered information and putting it into such shape that future students would be spared, to a considerable degree, the tremendous labor of bibliographic research, analysis, and synthesis which he devoted to the task. By doing that job, he not only produced a monumental synthesis of the regional geography of the United States—he also established a starting point from which future studies can proceed.

As the arduous work on the two regional volumes of the physiography of the United States was drawing to its close, Fenneman's attention again turned to some of the theoretical principles of geomorphology—stirred, no doubt, by several papers appearing at about that time, the authors of which invoked the existence of an imposing array of peneplains and partial peneplains in explaining the physiography of regions with which they were concerned. The result of Fenneman's thought on the problem of multiple peneplains appeared in 1936 in his paper entitled "Cyclic and Non-cyclic Aspects of Erosion." This was a much-needed analysis of the peneplain concept pointing out ways in which land forms that, in current practice, would commonly be interpreted as evidences of former peneplanation might be produced by normal erosive agencies without reference to baselevel and without anything of a cyclic nature being involved.

During the period when his interest was centered mainly on the regional physiography of the United States, Fenneman found time for other important activities. At the close of the first World War, he was a member of a group of geographers organized at President Wilson's request to gather information preparatory to the work of the Paris Peace Conference, his particular charge being the science work on Africa. During the 1920's he directed the Cincinnati Resource Survey, a project sponsored by the Commercial Club of Cincinnati for a survey of the natural and industrial resources of the Cincinnati area. That project was essentially geographical in its nature and was carried out mainly by an augmented staff of the De-

partment of Geology and Geography of the University. In 1922–1923 he served as chairman of the Division of Geology and Geography of the National Research Council, and in 1926 represented the United States at the Pan-Pacific Science Congress at Tokyo.

During the decade of the 1930's Fenneman was active in the Geological Society of America, serving on several important committees and as vice-president in 1932 and president in 1935. Of several short papers associated with this activity, a historical-philosophical essay, "The Rise of Physiography," will be of most interest to geographers.

In reviewing Fenneman's work and his broader concept of geography as a science, we find that he always looked upon Regional Geography as the fundamental basis of all geography. This concept of regional geography as the core around which all other phases of the subject are grouped, and as the common and essential bond uniting all of them into one science, seems to have been always present in Fenneman's geographic thinking. Under the title "The Circumference of Geography" this concept found clear and adequate expression in his presidential address before the Association of American Geographers at its fourteenth annual meeting in 1918.

Fenneman's contributions to learning were not confined to the fields of geography and geology. A sketch of his life work would omit an essential element if mention were not made of five educational papers published in *School and Society* and in the *Scientific Monthly,* and a sixth which it is hoped will yet be published. Written half-humorously, yet in serious vein, these essays give expression to his belief in the value of training in initiative and responsibility, and in the power to think and analyze, in contrast to the coddling, memory-work, and superficiality of much that now passes for "Education."

Nor would the sketch be complete without mention of an avocation which absorbed much time and thought during his later years—the writing of essays on a wide variety of topics, generally of a historical or philosophical nature and always full of a delightful humor. The occasion for the delivery of these essays was generally a meeting of the Literary Club of Cincinnati, of which he was an enthusiastic member, but occasionally also, a student or departmental gathering on the campus. Those who are familiar with the essays can only regret that they could not have had a wider audience.

Fenneman's achievements were given generous recognition by his fellow scientists. He was elected president of the Association of American Geographers in 1918; Chairman of the Division of Geology and Geography of the National Research Council in 1922; vice president and chairman of the Geology Section of the American Association for the Advancement of Science in 1923; President of the Geological Society of America in 1935; and

President of the Yellowstone-Bighorn Research Association in 1936. In 1935 he was elected Corresponding Member of the American Geographical Society. In 1938 he was awarded the gold medal of the Geographical Society of Chicago "For eminent achievements in the Physiography of the United States," and he was awarded the honorary degree of Doctor of Laws by the University of Cincinnati in 1940. Fenneman was also a member of Sigma Xi, an honorary member of Phi Beta Kappa, a member of the American Society of Naturalists, of the Cosmos Club of Washington, and of the Literary Club of Cincinnati.

The long list of scientific achievements and honors recited above indicates only part of what constituted Fenneman's greatness. Throughout his career he was also a *teacher*. His example, and his high regard for intellectual honesty and achievement and his demand for those qualities in his students exerted a profound influence on many men and women, not a few of whom have attained distinction, and all of whom look back to the contact with Dr. Fenneman as among the most significant events of their lives.

Students in his elementary classes were likely to be not a little frightened, at first, by a certain assumed gruffness of manner, perhaps an inheritance from R. D. Salisbury's well-known teaching method, and by a deep resonant voice which, it must be admitted, could become rather terrifying when occasion warranted. Those whose aims did not include serious attention to the subject at hand were, perhaps, justified in their fright, but the others, as they came to know him better discovered a warmth of heart and a willingness to help which they will always remember with gratitude.

Fenneman's advanced course in the Physiography of the United States was the one course that no advanced student in the Department would ever think of missing. It was there that his influence as a teacher was most effective, and many an active geologist today can testify to the debt he owes in the development of his intellectual powers to the training he received in that course.

On his twenty-eighth birthday, in 1893, Fenneman was married to Sarah Alice Glisan of Fredonia, N. Y., who died in 1920. They had no children. Fortunately, he had many devoted friends in Cincinnati to temper what might otherwise have been a lonely life after his wife's death. He was an active member and attendant at the Mount Auburn Presbyterian church. He had an active interest in national and international problems and in civic affairs in Cincinnati where he was widely known and his judgment highly respected. His interest in serious students was never-failing. He often proffered a helping hand, and at his death he bequeathed a substantial sum to Heidelberg College and an equal amount to the University of Cincinnati for the endowment of research aid and scholarship grants to students in Geology and Geography.

About two years before his death, Dr. Fenneman's former students and other friends arranged for the painting of a portrait which they then presented to the University of Cincinnati, where it will serve as a lasting memorial to the man who built up its Department of Geology and Geography, and to a great teacher who still lives in the work and in the affections of his many former students and of his colleagues.

NEVIN M. FENNEMAN

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